

**INTELLIGENT TRANSPORTATION SYSTEMS DEPLOYMENT
PROJECT FOR THE ADA COUNTY HIGHWAY DISTRICT
FY99 TREASURE VALLEY ITS**

**Final Self Evaluation Report
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EXECUTIVE SUMMARY

In 1999, the Treasure Valley area of the State of Idaho received a federal earmark of \$441,470 to develop an Incident Management Plan for the Treasure Valley and to design/deploy ITS devices for Interstates 84 and 184. The Ada County Highway District (ACHD), located in Boise, Idaho, was the lead agency for this project funded through the Federal Highway Administration (FHWA), with the addition of other local funds. The National Institute for Advanced Transportation (NIATT) was subsequently contracted by ACHD as part of the project to evaluate several aspects of the project. This document reports the results of that evaluation, following the guidelines established by the Federal Highway Administration (FHWA) in the ITS Earmark guidelines document.

Following an introduction giving the background and the structure of the ITS project, Chapter 2 describes the freeway operational characteristics and the Traffic Management Center (TMC) operational characteristics. Chapter 3 presents a before-and-after secondary crash analysis. The effectiveness of the incident management system in reducing incident-based congestion on I-84 and I-184 is presented in Chapter 4. Included are the results of a simulation based analysis, as well as a before/after congestion index analysis. Chapter 5 presents a before-and-after incident duration analysis; and Chapter 6 summarizes the self-evaluation that examined the nature of institutional cooperation before and during the project. The concluding chapter summarizes the study findings and includes an assessment of lessons learned during the project.

1. INTRODUCTION

1.1 Background and Project Description

The tremendous growth experienced by the Treasure Valley over the past ten years placed extreme stress on the area's transportation infrastructure. The Treasure Valley includes the cities of Boise, Garden City, Meridian, Eagle, Kuna, Star, Middleton, Nampa and Caldwell in Ada and Canyon counties, Idaho. Looking to the future, area transportation agencies initiated a planning effort in 1997 to investigate the potentials of utilizing modern Intelligent Transportation Systems (ITS) devices to reduce Treasure Valley's congestion levels, to increase safety and enhance traveler comfort, as well as to increase system efficiency. This plan, completed in 1999, outlined 59 ITS projects to be implemented over the next 20 years, including. The plan outlined three major projects:

1. The design, construction and implementation of a Traffic Management Center (TMC) for the Treasure Valley
2. The development of an Incident Management Plan (IMP) to encompass the freeway and the arterial systems, and
3. The design and implementation of ITS devices on I-84, I-184 and parallel arterials that serve as freeway diversion routes.

In 1999, the Treasure Valley received \$441,470 in FHWA ITS earmark funds to develop an integrated freeway and arterial traffic information system in an area that includes the I-84 corridor in both Ada and Canyon Counties and I-184 in Ada County. The stated goal of the funded project was to provide the information needed by the transportation agencies in the Treasure Valley to efficiently operate and manage the region's transportation system and to provide the information needed by the region's travelers to make the best use of its transportation system. The traffic information system would provide a way to gather real-time traffic data, to disseminate the information and to use it to make optimal decisions concerning traffic management. Additional funds to provide for the integrated freeway and arterial traffic information system came from the Congestion Mitigation and Air Quality (CMAQ) improvement program and other local agency funds.

A project team was formed, including personnel from the Ada County Highway District (ACHD), the Idaho Transportation Department (ITD), the Community Planning Association of Southwest Idaho (COMPASS), Boise State University and the National Institute for Advanced Transportation Technology (NIATT) of the University of Idaho.

1.2 Project Tasks

For the purpose of this report, the term “project” refers to all activities accomplished by the project team with FHWA and other committed funds. Five specific tasks were identified in the project:

1. Development of an incident management operations plan/manual for I-84 and I-184.
2. Development and design of a detection, closed circuit TV camera (CCTV) and communications system for I-84.
3. Deployment of ITS components and communication linkages on I-84.
4. Design and implementation of a virtual traffic management system.
5. Evaluation of the completed project.

1.2.1 Project Task 1: Develop an Incident Management Operations Plan for I-84 and I-184

One of the highest priorities identified in the 1997 Treasure Valley ITS planning study was the need to more effectively respond to incidents on I-84 and I-184 within the Treasure Valley. Incident management strategies can mitigate the effects of non-recurrent congestion by effectively identifying incidents when they occur, removing them as soon as possible, and letting the motorists know about diversion routes.

As part of this project, an incident management operations plan for the I-84/I-184 corridor was prepared jointly by personnel from Transcore (a consulting firm from Salt Lake City, Utah, hired by the project team) ACHD and ITD. The same group developed an operations manual that includes profiles of typical incidents and scripted instructions that are to be followed by all appropriate operating agencies. The operations manual has specific detour routes established for all 14 freeway segments within the Treasure Valley.

1.2.2 Project Task 2: Develop/Design Detection, CCTV and Communications Design for I-84 Corridor

The second task was to develop two design documents, one of which would identify locations for vehicle detector stations and closed circuit television (CCTV) cameras along I-84, and one to identify the communication linkages. Again, Transcore, ACHD and ITD personnel completed the documents, determining the type and location of detectors required to gather traffic flow data on the freeway and to determine how the data would be assembled in a central location.

1.2.3 Project Task3: Deploy Detection, CCTV and Communications Linkages on I-84

This task involved the deployment of the detection components, CCTV cameras and communication linkages on I-84 that had been selected in Task 2. This work was done jointly by ACHD and ITD crews.

Due to the limited budget for this project, only six CCTV cameras and 6 vehicle detection stations were installed on the 36 mile stretch of I-84 within the Treasure Valley. Because of the proximity of power sources needed to run the equipment, the ITS devices were installed at major freeway interchanges. All of the initial devices were brought back to the TMC via wireless communications methods. The CCTV cameras were installed on 50 foot poles and the vehicle detector stations were radar-based units mounted on 25-foot poles. The detector stations were powered by solar panels with battery back-ups.

1.2.4 Project Task 4: Design and Implementation of a Virtual Traffic Management System

The heart of many ITS systems is the management system where all of the data that has been gathered resides. The initial phase of this task, conducted by Transcore, ACHD, ITD, Boise State University and NIATT, was to investigate incident management software packages currently being used by other agencies across the U.S. The options were either to identify and

buy an incident management package for the Treasure Valley or have the University of Idaho write a package for the Treasure Valley.

After recognizing the complexity of Advanced Traffic Management System (ATMS) software packages, the project team concluded that the best option was to purchase an off-the-shelf ATMS software package. Chapter 6 will include an in-depth description of the ACHD incident management software procurement process.

1.2.5 Project Task 5: Project Evaluation.

The purpose of this task was to provide a thorough evaluation of the completed project. NIATT (with support from Boise State University) was to conduct a review of different components of the project. The report would include an evaluation of

1. The effectiveness of the incident management system in reducing incident-based congestion on I-84 and I-184,
2. The effectiveness of the incident management system in reducing the number and severity of secondary accidents on I-84 and I-184, and
3. The nature of institutional cooperation in completing all project tasks, and the manner in which any conflicts or disputes were resolved, including a self-assessment by all project team members and an assessment of lessons learned during the project.

1.3 The Process of Incident Management

The process of managing an incident has four distinct stages: detection, response, clearance and, with full capacity restored, recovery. Figure 1 1 graphically represents incident-based delay with and without an incident management system.

In general, the impact of incidents on traffic flow can be minimized by implementing incident management programs that

- Reduce the time to detect and verify the incident,
- Reduce the response time for personnel and equipment to arrive at the incident location,
- Effectively manage on-site personnel, equipment and traffic,

- Implement effective diversion route plans to reduce incident-based delay,
- Reduce the time to clear the incidents, and
- Provide timely and accurate information to motorists, including possible diversion routes.

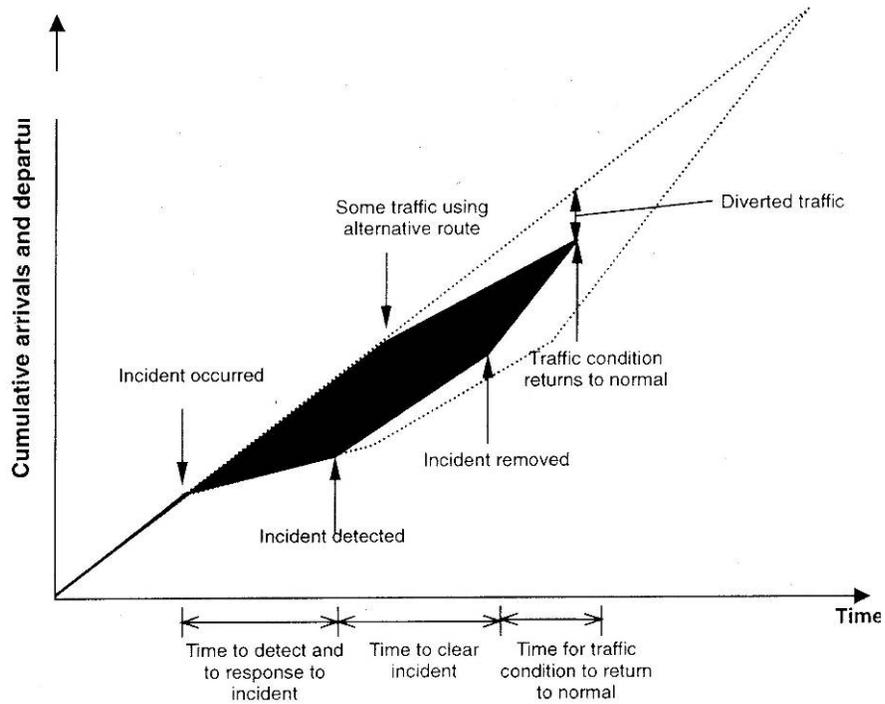


Figure 1 1 Incident-Based Delay with and without an Incident Management System.

1.4 Treasure Valley ITS Projects

In an effort to improve travel conditions in Idaho’s Treasure Valley Corridor, ACHD collaborated with other transportation agencies in the Treasure Valley area to develop a Regional ITS Architecture. This regional architecture plan was completed in 1999 and outlined 59 ITS projects to be implemented over the next 20 years. Since the completion of the Treasure Valley ITS Architecture, over 6 million dollars in ITS deployment projects have been completed. These projects were funded thru CMAQ and ITS Earmark grants. Three major projects were the design, construction and implementation of a Traffic Management Center (TMC) for the Treasure Valley, the development of an Incident Management Plan (IMP) that encompasses the freeway and the arterial systems, and the design and

implementation of ITS devices on I-84, I-184 and parallel arterials that serve as freeway diversion routes.

1.4.1 Treasure Valley Traffic Management Center (TMC)

As part of the ITS deployment plan in the Treasure Valley area, ACHD, in partnership with ITD, completed work on a state-of-the-art TMC in January of 2000 (Figure 1 2). The TMC controls 240 of ACHD's 356 traffic signals. The TMC also manages the operation of most of the arterial streets and the freeways (I-84 and I-184) within the Treasure Valley that are under ITD's jurisdiction



Figure 1 2 Ada County Highway District Traffic Management Center.

This unique, joint operation between ACHD and ITD facilitates integrates freeway and arterial system management, resulting in more efficient traffic operation. The TMC will be particularly valuable during incident situations when some of the freeway traffic can be diverted onto the arterial system network. The TMC also operates strategically-located Dynamic Message Signs (DMS) when necessary and uses CCTV systems to provide

surveillance. Figure 1 3 illustrates the locations of the ITS components within the Treasure Valley area.

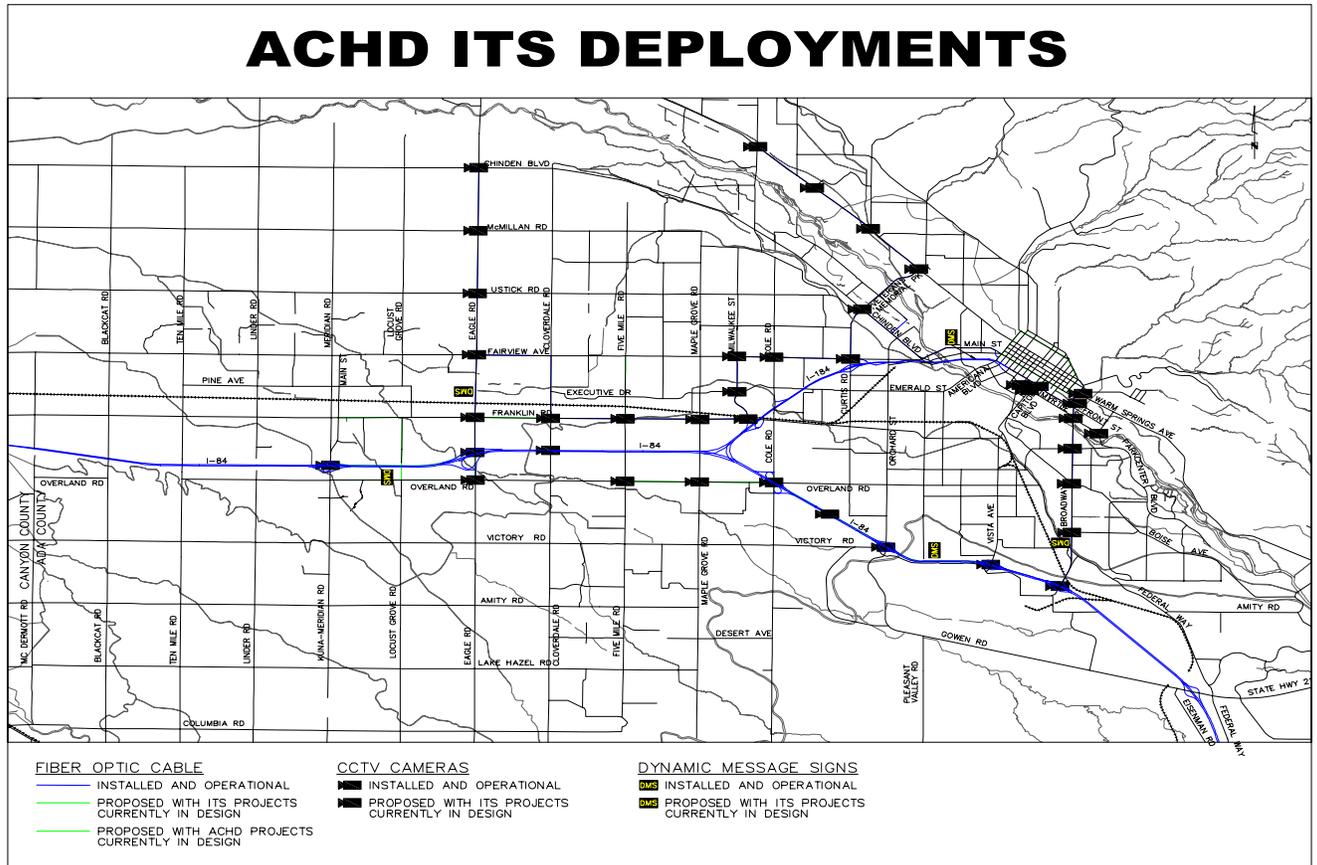


Figure 1 3 Treasure Valley ITS Components and Their Deployment Locations (2004).

1.4.2 Development of an Incident Management Plan

The incident management plan (IMP) developed for the Treasure Valley coordinates incident management efforts among the transportation agencies and emergency service providers in the area. The IMP provides scripted instructions for incident site management, rerouting of traffic along alternative routes and protocols for the TMC operator. The plan also provides a comprehensive checklist of steps that should be taken by all the response agencies to most effectively manage an incident, from detection, through clearance and finally to restoration of traffic flow on the freeway. A sample diversion route map from the IMP is shown in Figure 1 4.

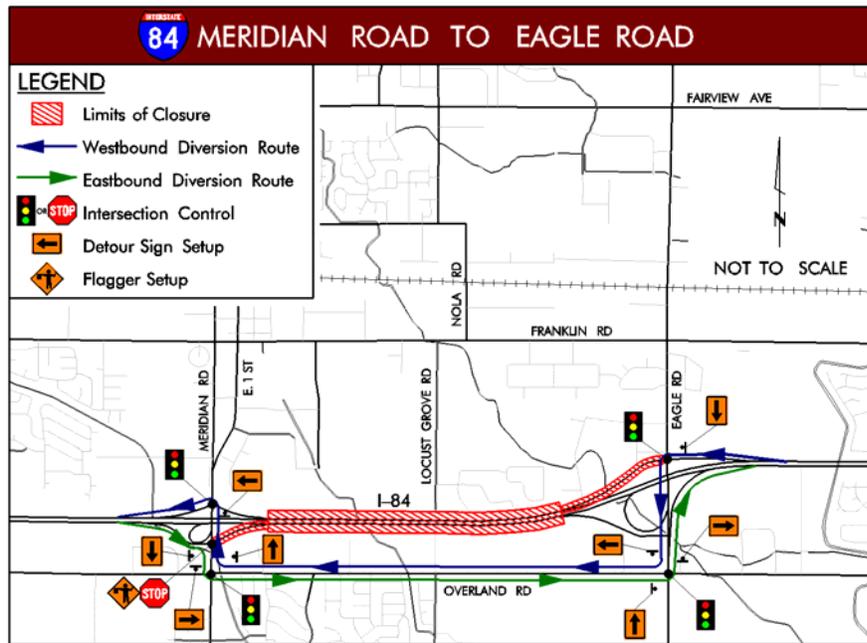


Figure 1 4 Treasure Valley I-84 Diversion Route Map.

1.5 Report Organization

This report is organized in five chapters. Following an introduction, the freeway operational characteristics and the TMC operational characteristics are presented in Chapter 2. Chapter 3 presents a before-and-after secondary crash analysis. The effectiveness of the incident management system in reducing incident-based congestion on I-84 and I-184 is presented in Chapter 4. The chapter includes the results of a simulation-based analysis as well as a before and after congestion index analysis. Chapter 5 includes a before and after incident duration analysis, and Chapter 6 summarizes the evaluation study that examined the nature of institutional cooperation in completing all project tasks. The report concludes with Chapter 7 by presenting the evaluation study findings and conclusions, including an assessment of lesson learned during the project.

2. FREEWAY AND TMC OPERATIONAL CHARACTERISTICS

2.1 Freeway Data Collection and Management

ITD has embedded inductive loop sensors at fairly regular intervals along I-84 through Boise. These sensors—Automated Traffic Recorders (ATRs)—provide speeds and length of vehicles by individual loops on a lane-by-lane basis. (ATR) data is available in four formats, but the format that was appropriate for the purpose of this study is called the Individual Vehicle Records (IVR) format. IVR provides the most detailed level of data obtainable, so that data at any level of aggregation can be gathered.

Table 2.1 lists the location of the ATRs on I-84 within the Treasure Valley Corridor study and the type of data collected at each station. Because speed and occupancy measurements, which are typically used by incident detection algorithms, are the key factors in this study, stations that report volume only (West Nampa and Vista Rd.) were excluded from the data collection activities. However, some archived data for these stations were used to establish traffic flow profiles at these locations. **Error! Reference source not found.** depicts the approximate locations of the detector stations in this segment of I-84 through the Boise urban area. The sets of three-digit numbers on either side of this schematic denote the ATR number.

2.1.1 Freeway Data Analysis

The freeway data obtained from I-84 was organized into separate files, each file including traffic data for one detection station for a 24-hour period. Analysis of the freeway data was performed using the Statistical Package for Social Science software (SPSS v.10). The analysis of the data included generating speed confidence intervals for 14 locations along the freeway using the entire dataset. The speed confidence intervals represent the range of speeds that can be expected at these locations under normal (non-incident) traffic conditions. The speed confidence intervals were obtained for each 15-minute period and under different weather conditions. The data was analyzed using an ATR analysis tool developed by NIATT (Figure 2 2).

Table 2-1. Automatic Traffic Recorders Located on I-84 within the Treasure Valley Corridor

Site Number	Location	Milepost	Data Type
094	West Nampa eastbound (EB)	32.4	Volume
	West Nampa westbound (WB)	32.4	Volume
142	Robinson Rd. EB	39.7	Binned
	Robinson Rd. WB	39.7	Binned
121	Five Mile EB	47.93	Binned
122	Five Mile WB	47.93	Binned
260	Overland EB	49.73	Binned
263	Overland WB	49.73	Binned
261	Orchard EB	51.29	Binned
262	Orchard WB	51.29	Binned
263	Vista Rd. EB	53.1	Volume
264	Vista Rd. WB	53.1	Volume
265	Broadway EB	53.92	Binned
	Broadway WB	53.92	Binned
002	Jeans Place EB	58.73	Raw
	Jeans Place WB	58.73	Raw
87	Blacks Creek EB	62.1	Raw
	Blacks Creek WB	62.1	Raw

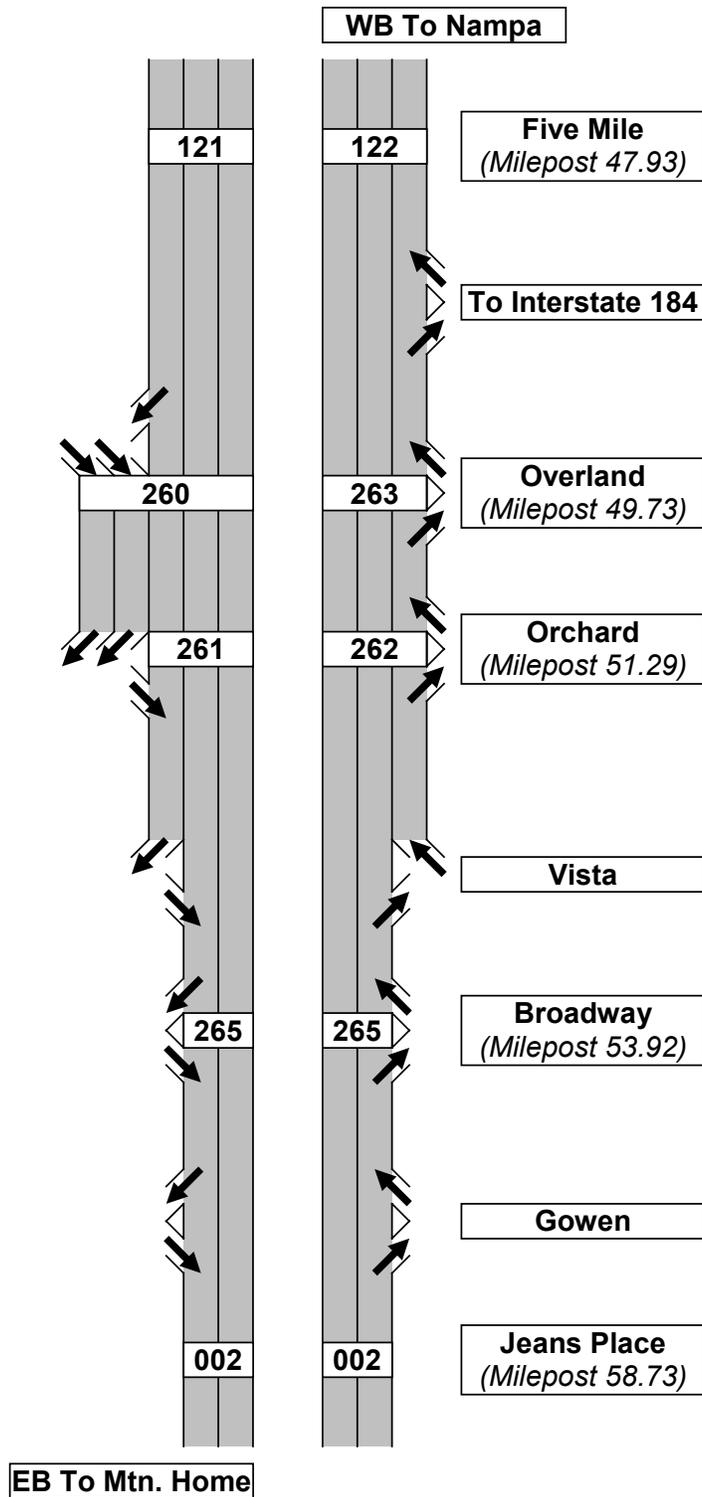


Figure 2 1 Detector Station Schematic.

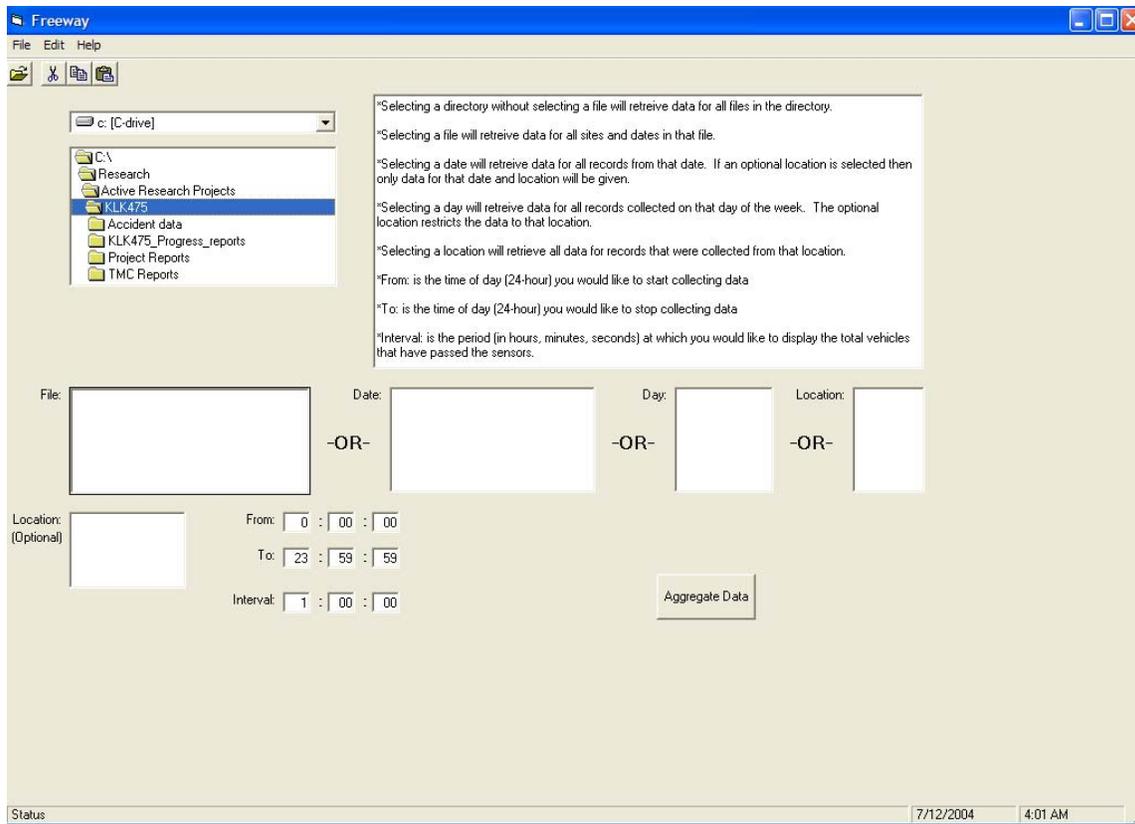


Figure 2 2 NIATT-ATR Data Analysis Tool.

2.2 Traffic Flow Profiles during Normal Operating Conditions

The traffic data was first analyzed to determine the traffic flow characteristics on the Treasure Valley freeway corridor during normal operating conditions. This step was important to establish a benchmark to represent normal operations with which to compare the performance of the network during incident situations. Graphs in Figure 2 3 present the average hourly traffic volumes during the morning (7–9 AM) and afternoon (4–6 PM) peak periods at different locations along Eastbound and Westbound I–84 under normal conditions. Graphs in Figure 2 4 present the volume/capacity ratio at the same locations for both the morning and afternoon peak periods.

As the graphs show, the volume to capacity (v/c) ratio for most parts of the freeway is less than 0.73, indicating stable flow conditions with a level of service ranging from A to C. However, a segment of the freeway from milepost 48 to milepost 49 and from milepost 53 to

milepost 55, the v/c ratio ranged from 0.73 to 0.91, indicating high density and near capacity flow conditions with a level of service D.

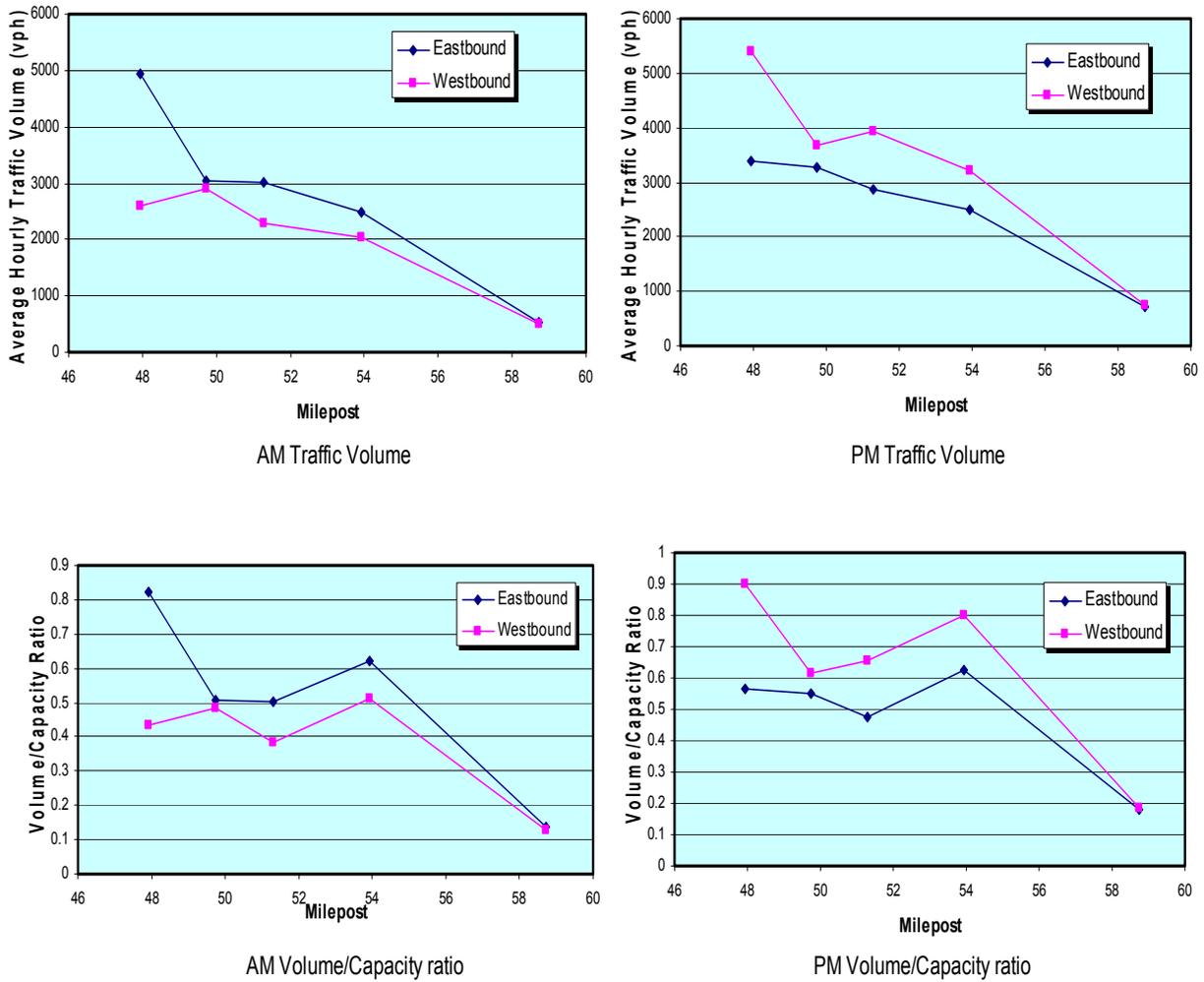


Figure 2.3 Traffic Flow Profiles for the Treasure Valley Corridor.

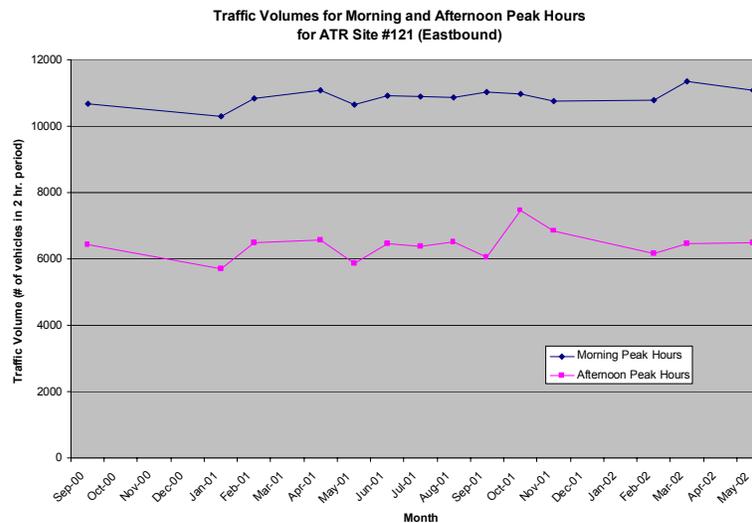
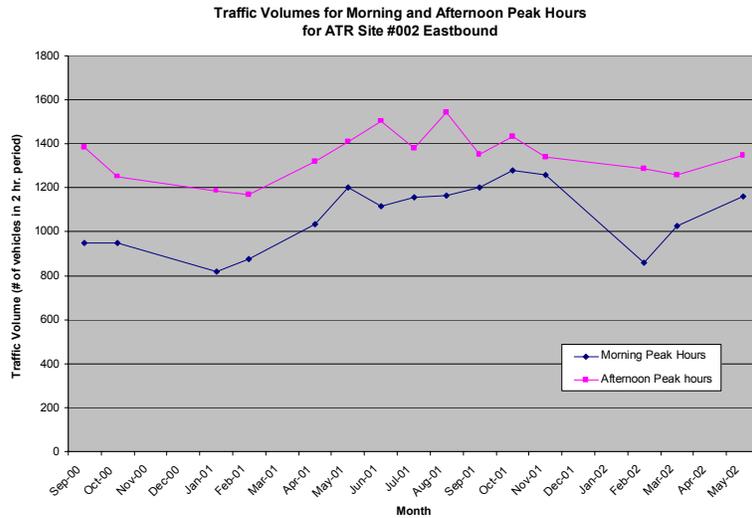
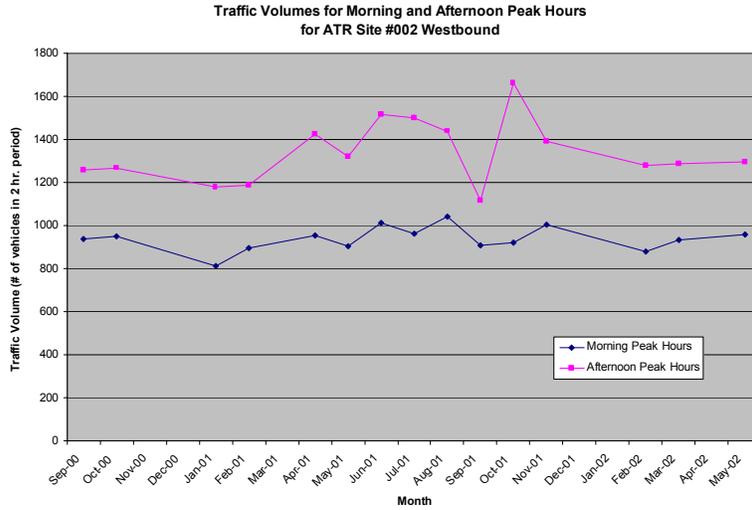


Figure 2 4 Average Peak-Hour Traffic Volumes. (September 2000—May 2002).

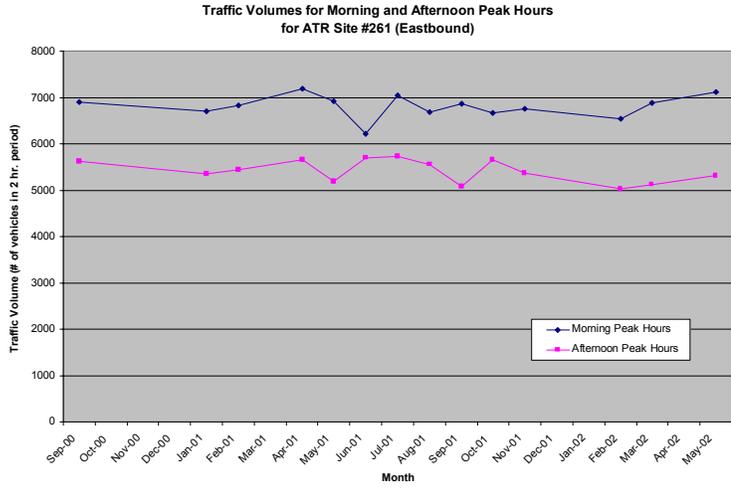
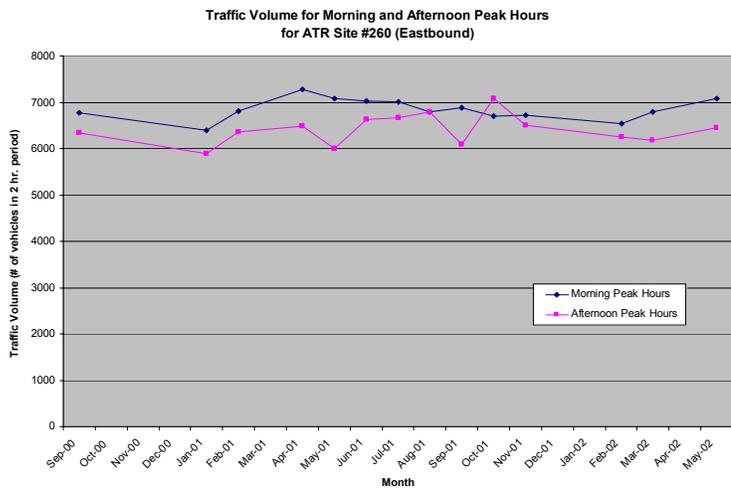
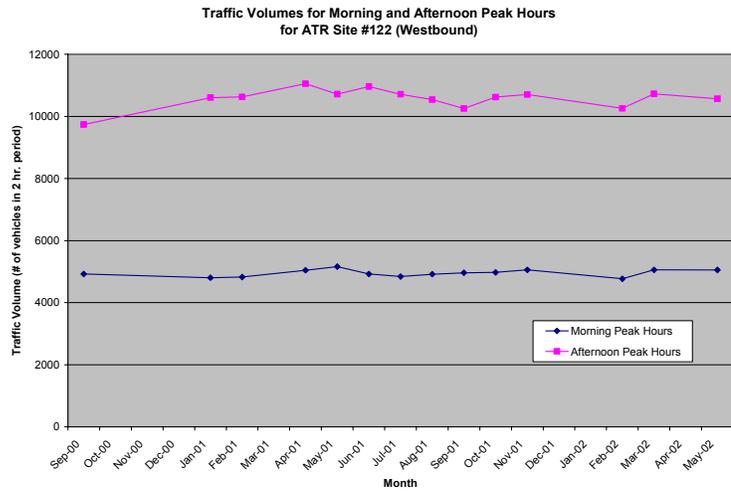
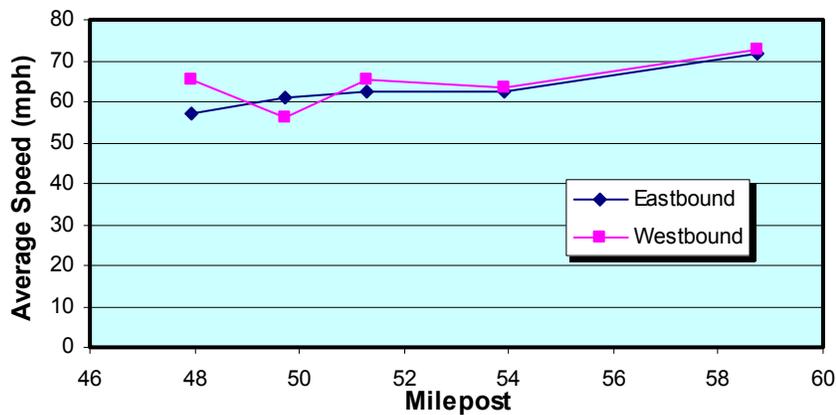


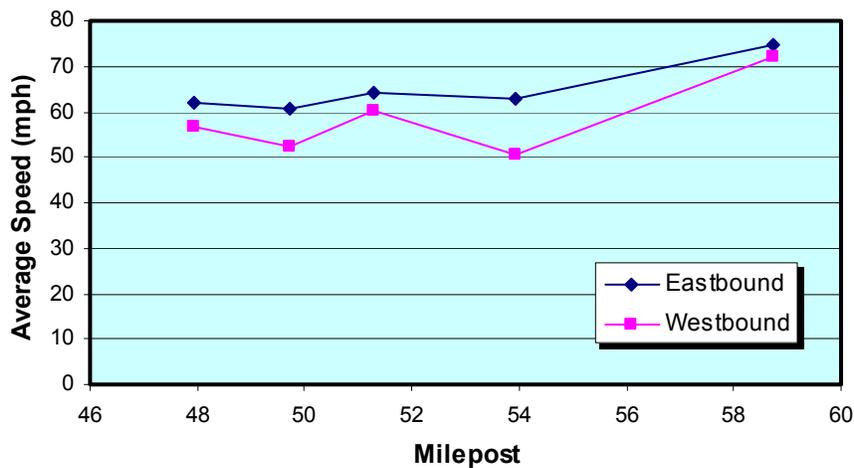
Figure 2-4 (Cont.) Average Peak-Hour Traffic Volumes. (September 2000—May 2002).

2.3 Speed Profiles during Normal Operating Conditions

The graphs below (Figure 2 5) present the average speed during the morning and afternoon peak periods at different locations along Eastbound and Westbound I-84. The average speed during the peak periods ranged from 59 mph to 61 mph, which is close to the free-flow speed of 64 mph. This again indicates that the freeway operates under stable free-flow conditions. The average speed in the congested areas ranged from 49 to 54 mph, indicating a high density with near capacity flow conditions. The posted speed limit on this segment of freeway is 65 mph.



AM Peak



PM Peak

Figure 2 5 Average Speed on the Treasure Valley Corridor.

Typical weekday 24-hour speed profiles are provided in Figure 2.6. At Broadway, in the high-density area, the average speed during the non-peak period was 63.4 mph, representing stable free-flow conditions; whereas the average speed during the afternoon peak period was 52.9 mph, indicating high-density and near capacity flow conditions. At Five Mile Road, the average speeds during the non-peak and morning peak periods were 63.1 mph and 58.2 mph, respectively. This again indicates that traffic at this location is functioning in a stable, free-flow condition during both the peak and the non-peak periods.

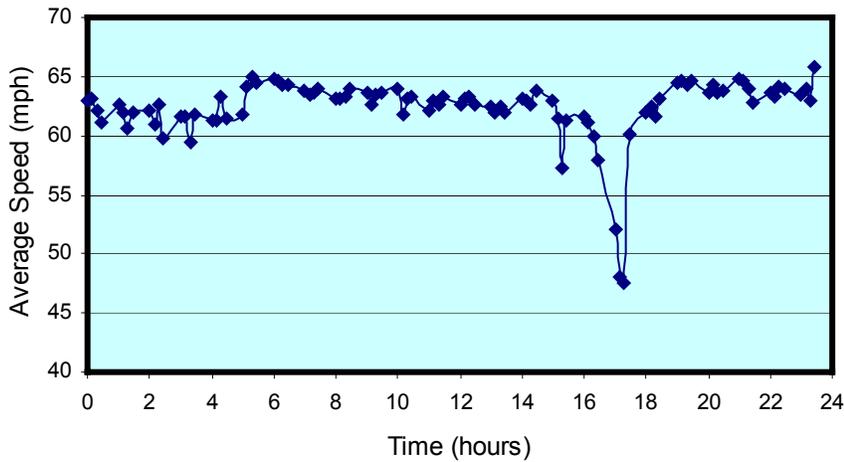


Figure 2.6 a Average Speed Profile for Westbound Traffic at Broadway Avenue.

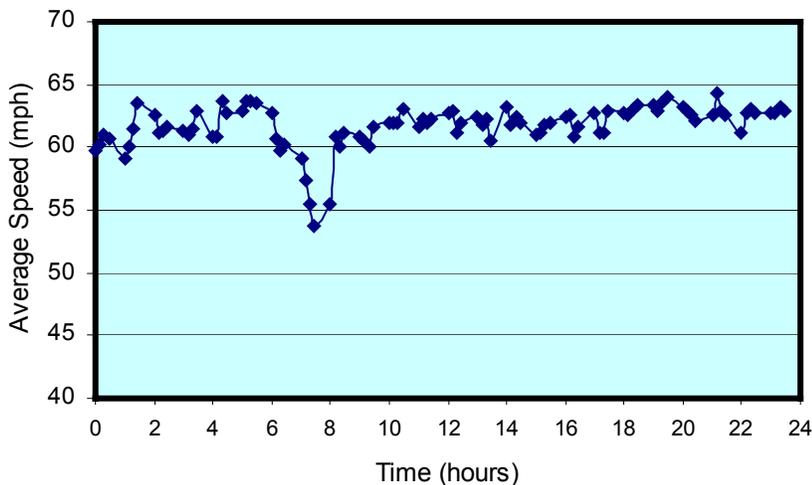


Figure 2-6-b Average Speed Profile for Eastbound Traffic at Five Mile Road.

It was also important to document changes in the average speed under different weather conditions. Figure 2 7 Shows the speed profile at Broadway on Friday January 19, 2001, when the weather report for the Boise area indicated snowfall beginning at 11:00 AM. The figure shows a significant reduction in the average speed during snowy weather conditions. The average speed during this period dropped from 62.3 mph to 43.1 mph. The overall average reduction in speeds for all locations during snowy weather conditions was 17.3 mph. During rainy weather conditions, however, the reduction in the freeway operational speed was less drastic and averaged 1.8 mph.

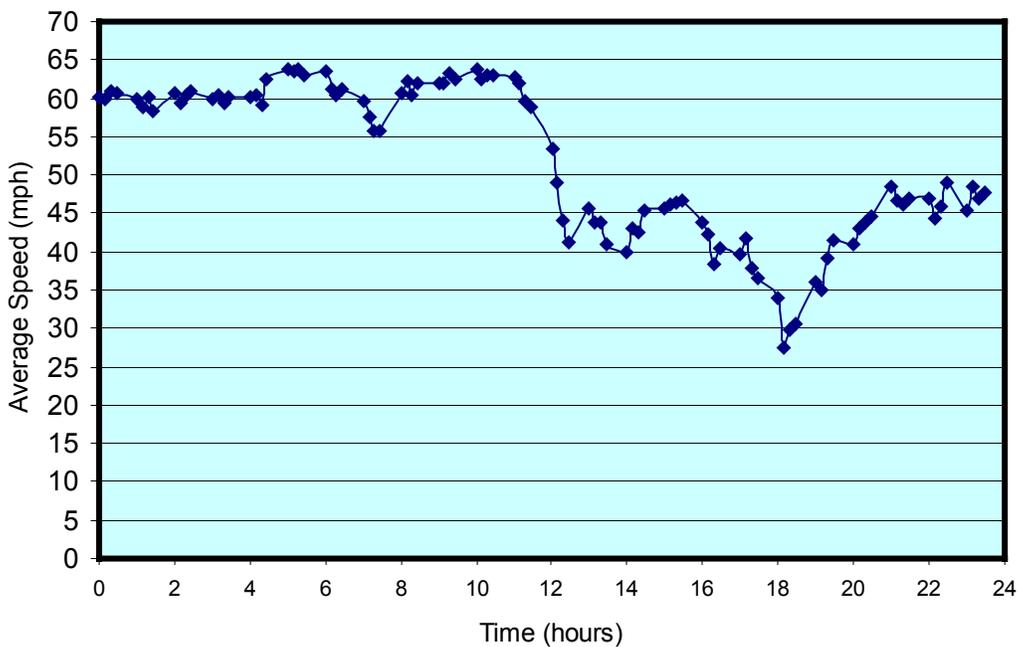


Figure 2 7 Average Speed Profile for Eastbound Traffic at Five Mile Road during Snowy Weather Conditions.

2.5 TMC Operational Characteristics

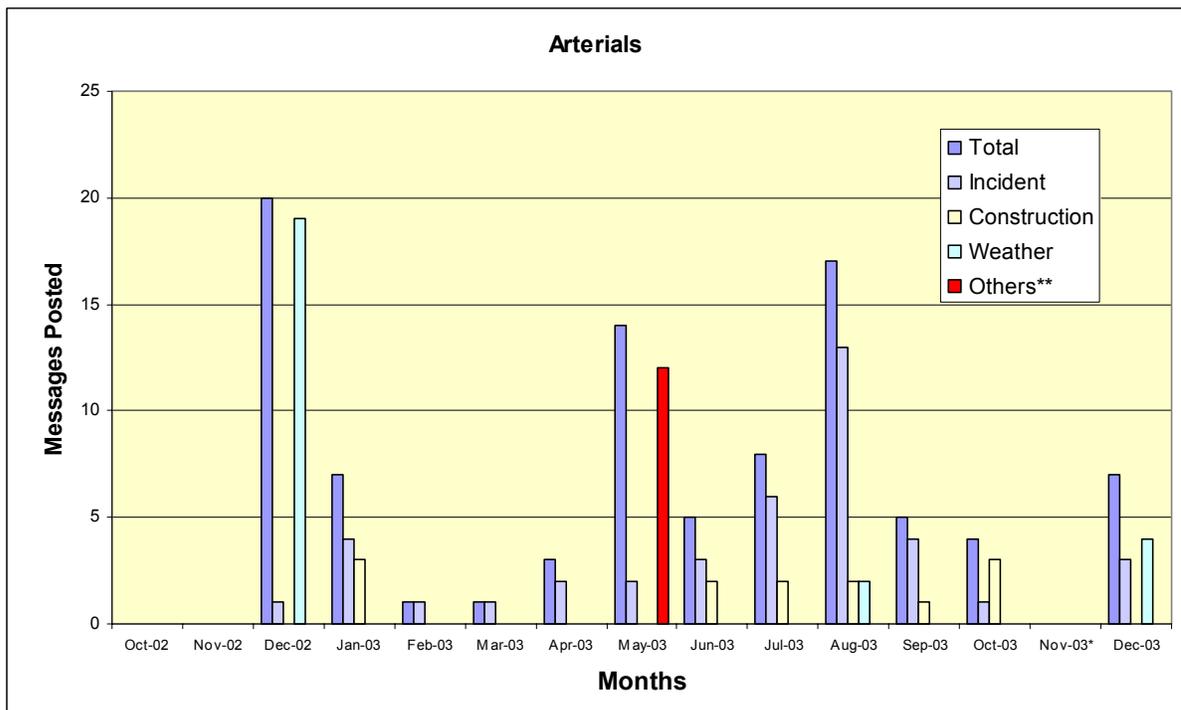
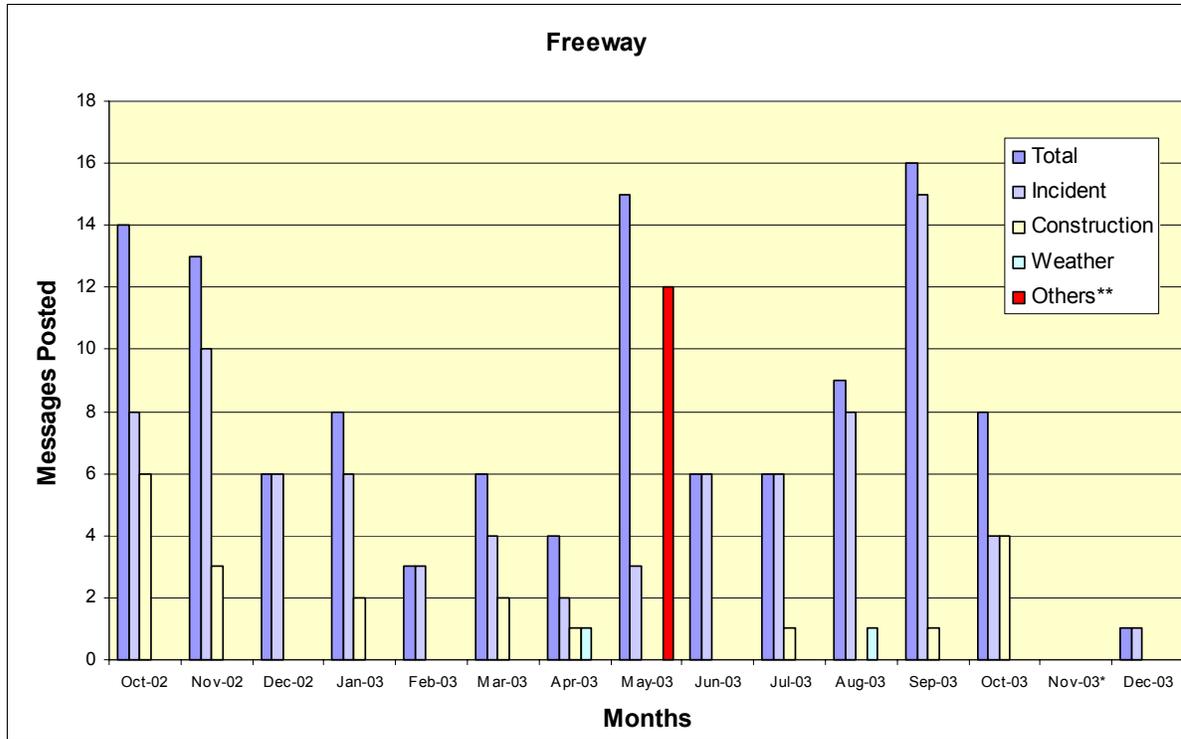
ACHD's TMC controls various ITS devices located along I-84 and I-184 corridors in and around Boise. The TMC operates 13 closed circuit television (CCTV) cameras located on I-84 and I-184 and 35 cameras on nearby arterial streets. The cameras are used to identify and/or confirm any traffic problems in the area. Also, operators in the TMC control three freeway and two arterial dynamic message signs (DMS). The signs assist drivers by warning of accidents, construction or severe weather events and/or providing other traffic information. Prior to the full ITS deployment on I-84 and I-184, very few DMS messages were posted on the freeway signs because of the lack of CCTV cameras on the freeway. The CCTV cameras were installed a year after the installation of the DMS signs. ACHD staff was reluctant to post messages on the DMS signs without being able to verify the nature of incidents.

2.5.1 Analysis of Use of TMC

Data used for this analysis was obtained from the ACHD TMC Monthly Reports and the ACHD Monthly Posted Message Summary Tables. The TMC Monthly Report categorizes incident data based on an events location, freeway or arterial street. The Posted Message Summary Table provides monthly information concerning every message posted on the DMS signs. Each entry includes the date displayed, location of the sign, start and stop display times, and the text of the message displayed.

2.5.2 Number and Type of Messages Displayed

From October 2002 through December 2003, ACHD DMS signs displayed a total of 265 messages—173 along Interstates 84 and 184, and 92 along arterial streets (average 17.67 messages per month) (Figure 2 8). Over 31 percent (84 messages) of all messages posted during the study time period were displayed in December 2002 due to bad winter weather situations. In November 2003, the DMS sign software was upgraded from Daktronics to IBI Group ATMS, accordingly, no messages were posted during that month. Excluding the data from December 2002 and November 2003, the TMC displayed an average of 13.43 messages per month.



* No messages were posted in November 03 on any DMS signs due to software upgrade

**"CLICK IT" messages were posted on May 2003 at the request of the Office of Highway Safety

Figure 2 8 Number of DMS messages posted.

On the freeways, 47.40 percent of the messages displayed were incident related, 11.56 percent construction related, and 34.68 percent weather related. Excluding the data from December 2002, 71.34 percent of all messages were incident related, 17.39 percent were construction related, and 1.74 percent were weather related. Signs located on arterial streets displayed 44.56 percent incident related messages, 14.13 percent construction related messages, and 27.17 percent weather related messages.

2.5.3 Incident Detection

The occurrence of an incident is detected or reported to the TMC in three ways. A private traffic broadcasting company, Ida West Broadcasting, reports incidents to the ACHD TMC staff, TMC staff can monitor a police scanner for incidents, or the TMC staff personnel detect the incident directly using the CCTV cameras located along I-84/I-184 or several arterial streets. Graphs in Figure 2 9 illustrate the method by which the incidents were reported on both the freeways and arterials.

On average along the freeways, IdaWest reported 29.60 percent of all incidents; police scanners reported another 50.18 percent; and the TMC staff using CCTV cameras detected 19.49 percent. Along arterial streets, IdaWest reported 42.77 percent of all incidents; police scanners reported another 44.41 percent; and the TMC staff using CCTV cameras detected 12.07 percent of all incidents. Graphs in Figure 2 10 illustrate the number of incidents that the TMC was able to confirm by using CCTV cameras.

Ideally, the TMC would be able to confirm all incidents; however, during the study period, only 74.98 percent of freeway incidents and 87.15 percent of arterial incidents were confirmed by the cameras. This project installed CCTV cameras at only six locations on the 35-mile stretch of I-84 within the Treasure Valley. The minimum distance between these cameras is one mile and the maximum distance between cameras is six miles. Until the final CCTV spacing of one mile is achieved on the Treasure Valley freeway network, the confirmation percentage will be under 100 percent. ACHD's goal is to be able to confirm 100 percent of all incidents on the freeways and major arterials that serve as freeway diversion routes.

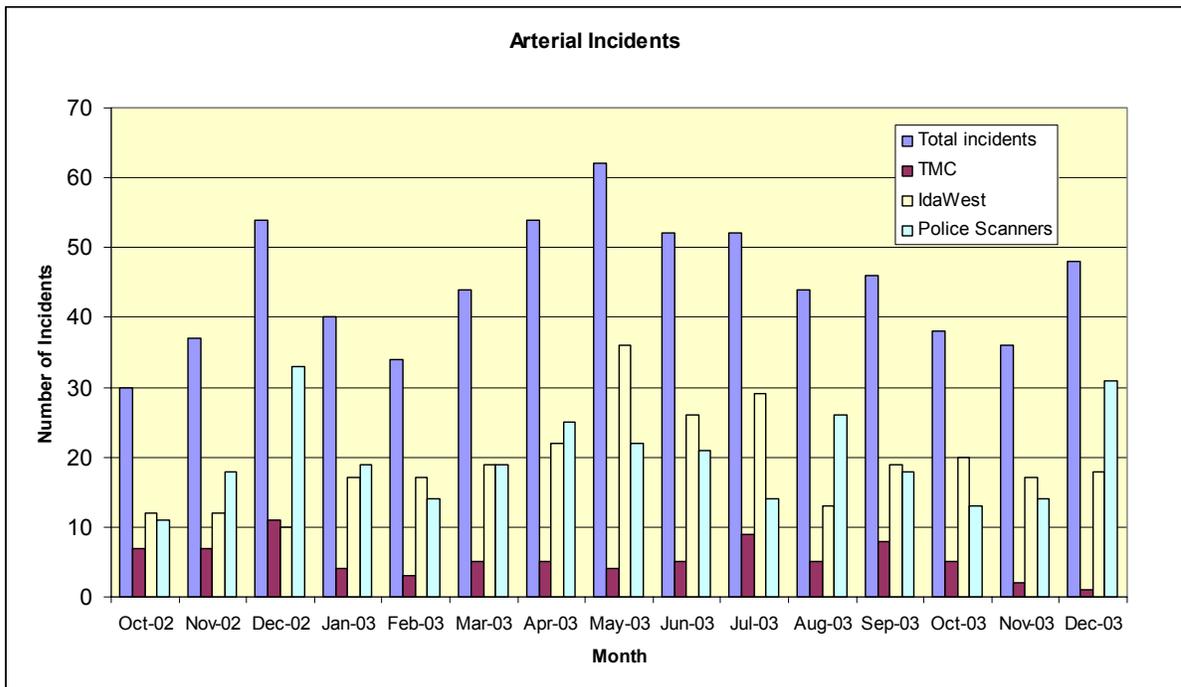
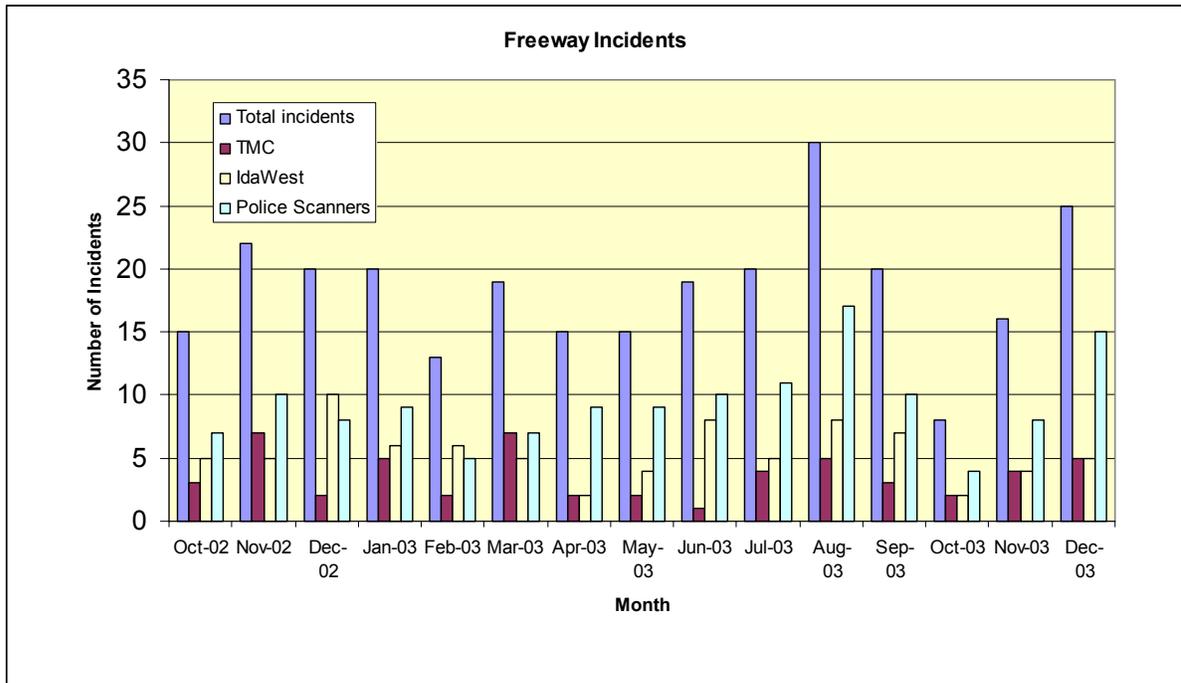


Figure 2 9 Incident detection methods.

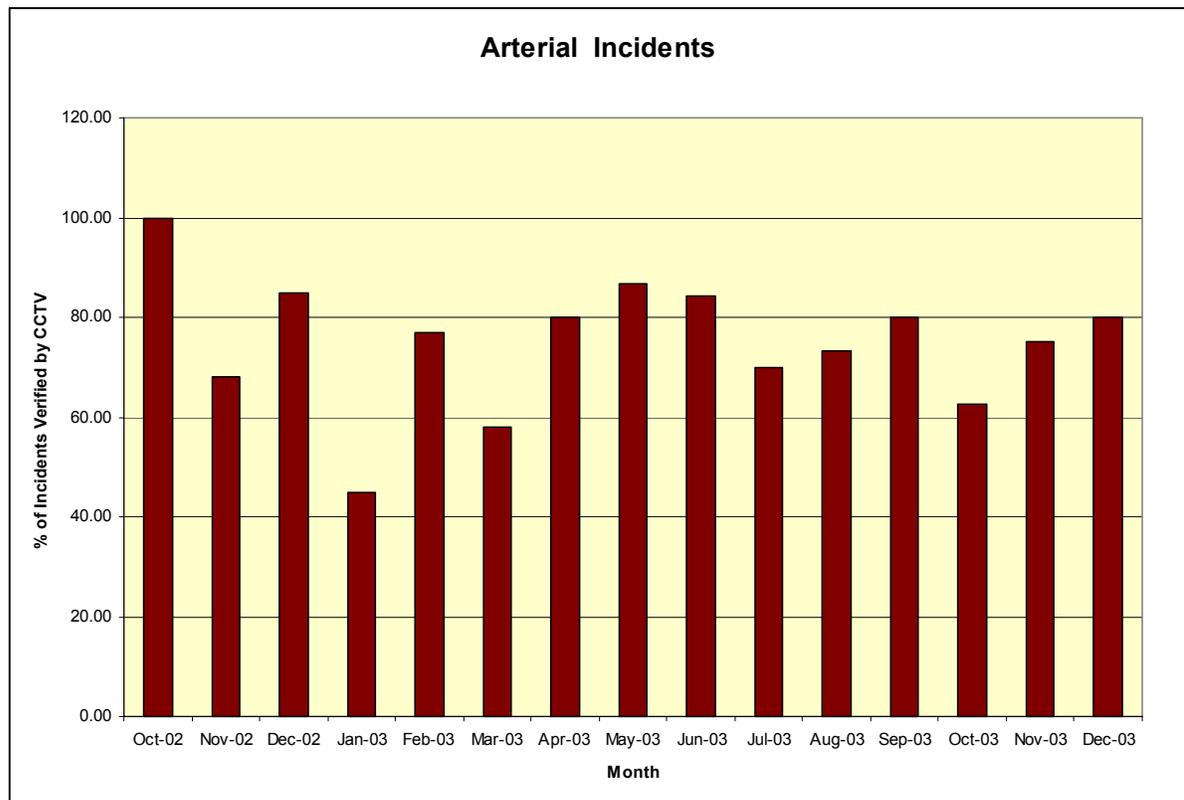
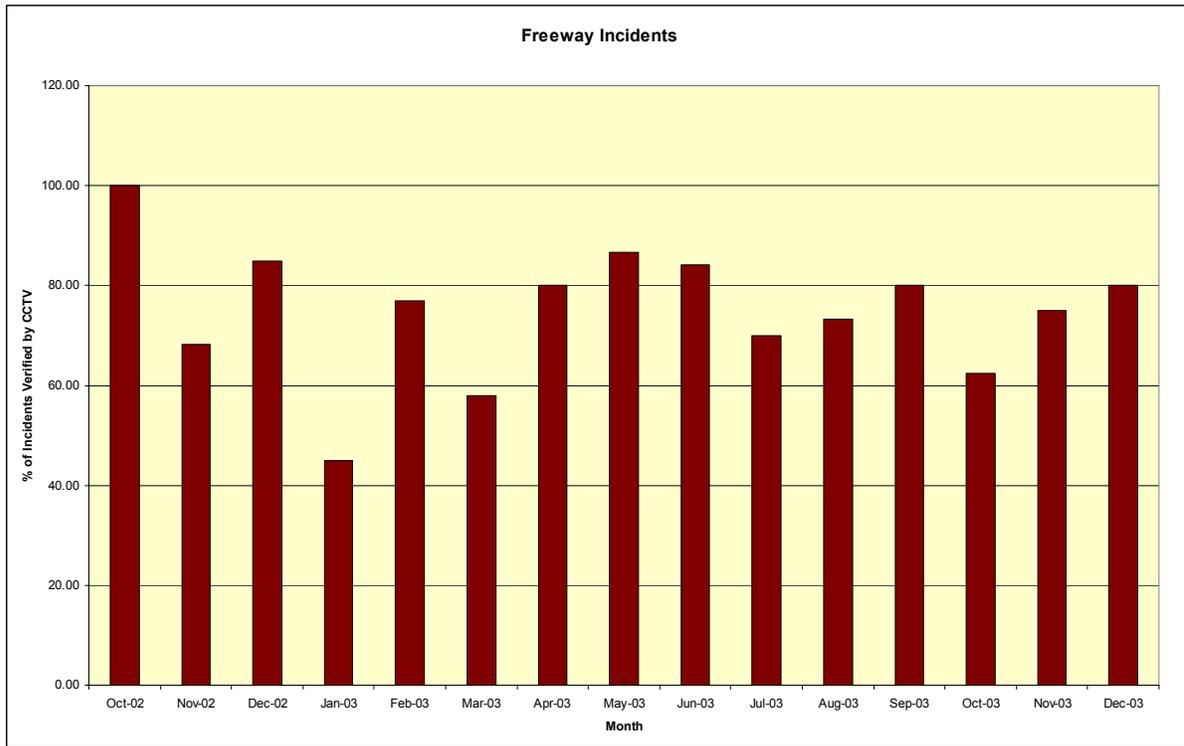


Figure 2 10 Incidents verified by CCTV.

2.5.4 Duration of Messages

DMS messages on freeways were displayed for an average 56.23 minutes for incidents, 1.87 days for construction work and 2.11 hours for weather (Figure 2 11). The arterial messages were displayed an average 44.36 minutes for incidents, 1.43 days for construction and 7.25 hours for weather-related messages.

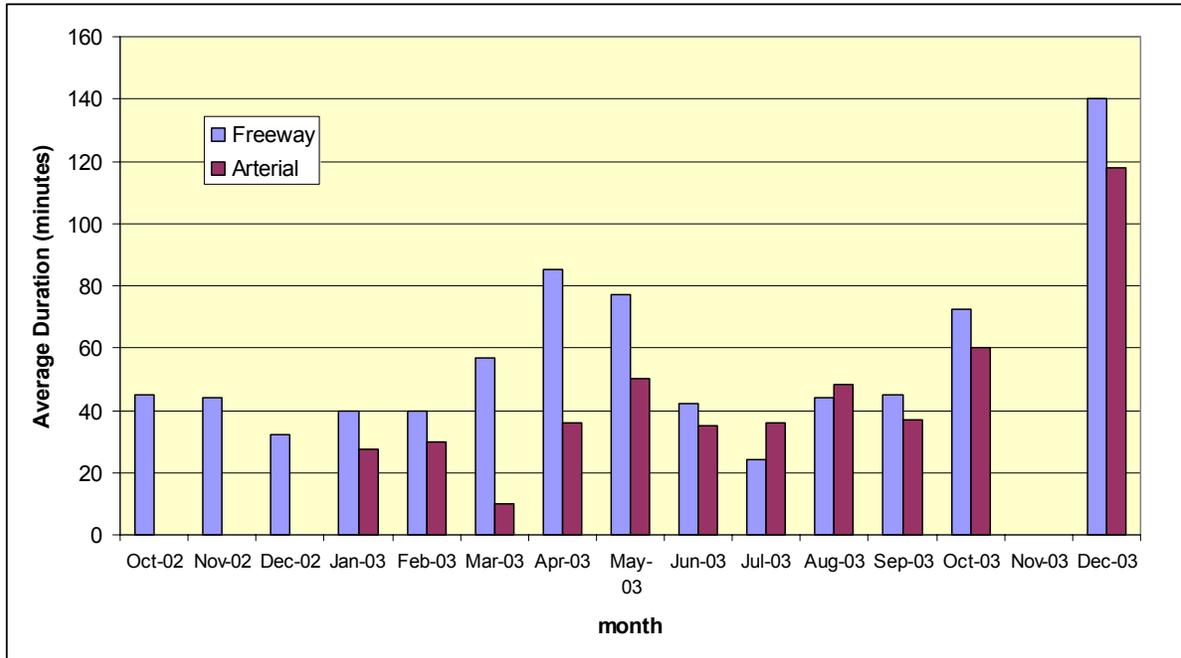


Figure 2 11 Average duration of DMS incident-related messages.

2.5.5 Type of Messages

ACHD displayed over 70 different text messages during the study period (Figure 2 12). The largest percentage of messages informed drivers of incidents with messages such as “Crash Ahead – Expect Delays” (45.8 percent.) Other messages displayed were lane reduction information (18.1 percent), extreme weather conditions (9.7 percent), roadwork on exit ramps (6.9 percent), heavy-congestion-ahead (6.9 percent), air quality alert (5.6 percent), dense fog (4.2 percent), and stalled-vehicle-ahead (1.4 percent). 1.4 percent of messages were used for testing purposes.

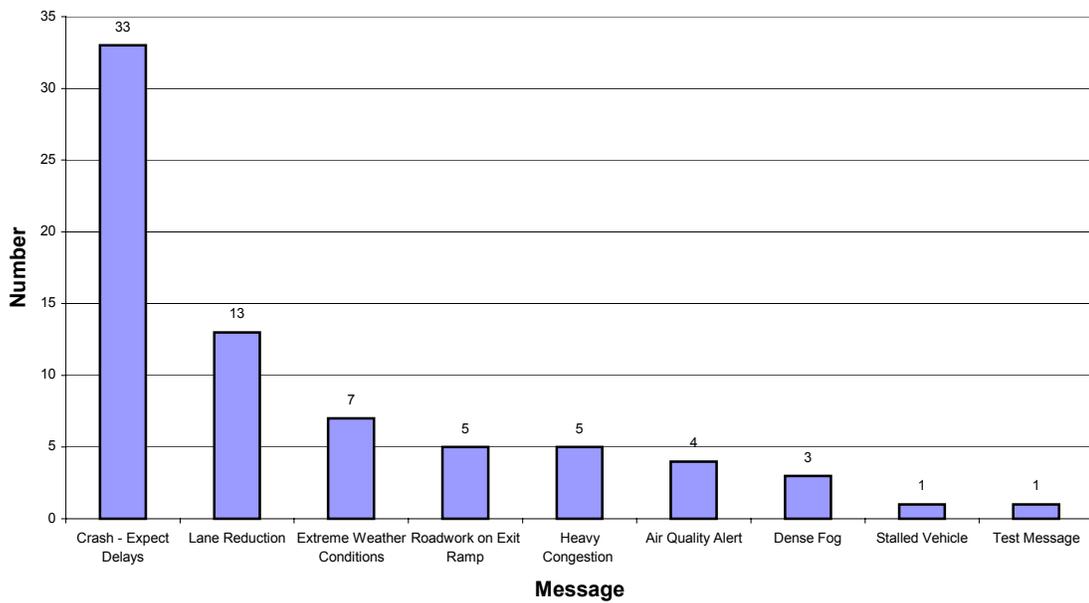


Figure 2 12 Type of DMS messages.

On multiple occasions during the study period, the TMC displayed a warning to drivers of a crash from seven to thirteen miles ahead. Unless the congestion actually extends for up to thirteen miles, warnings at this distance seem excessive and suggest the need for additional signs. A summary of TMC operation in 2003 is presented in Table 2-2.

Table 2-2. 2003 TMC Operation Summary

	Freeway	Arterial
No. of Incidents:	220	550
No. Detected by TMC:	42 (19.1%)	58 (10.6%)
No. Reported by IdaWest:	62 (28.2%)	253 (46.0%)
No. Reported by Scanner:	114 (51.9%)	237 (43.1%)
No. Verified by CCTV:	160 (72.2%)	486 (88.4%)
Other:	2	2
No. of DMS Messages Posted:	82	71
Incident related:	58 (70.7%)	40 (56.3%)
Average Duration(hr):	61.46 Min.	44.36 Min.
Construction related:	10 (12.2%)	14 (19.7%)
Average Duration(hr):	50.8 Hours	48 Hours
Weather related:	2 (2.4%)	6 (8.4%)
Average Duration(hr):	6.38 Hours	9.88 Hours
Other:	12 (14.6%)	12 (16.9%)

2.5.6 Reliability of System Devices

Table 2-3 lists the number of operational DMS signs and CCTV cameras. Table 2-4 lists the failure rate for different devices in the system. Freeway CCTV cameras and freeway vehicle detectors were the most reliable components of the systems, with no failures during the four year installation and operation period.

DMS signs have had two different problems: DMS controller failures and DMS communication failures. Over a four-year period, there were 10 controller failures (0.83 Failure/year/sign). During the same period, there were numerous communication problems that prevented communication to/from the signs. The failures are attributed to wireless communications problems and non-reliable cellular modems. ACHD is in the process of installing fiber optic cable to these DMS to help eliminate these problems.

Table 2-3. Number of Operational Devices [October 2002 through December 2003]

	CCTV				DMS			
	Freeway		Arterial		Freeway		Arterial	
Month	Total	Operational	Total	Operational	Total	Operational	Total	Operational
Oct-02	6	4	14	14	3	3	2	1
Nov-02	8	8	19	19	3	3	2	1
Dec-02	8	8	19	19	3	3	2	2
Jan-03	8	8	23	23	3	3	2	2
Feb-03	8	8	26	26	3	3	2	2
Mar-03	8	8	29	29	3	3	2	2
Apr-03	8	8	29	29	3	3	2	2
May-03	8	8	29	29	3	3	2	2
Jun-03	8	8	29	29	3	3	2	2
Jul-03	8	8	30	30	3	3	2	2
Aug-03	8	8	31	31	3	3	2	2
Sep-03	9	4	30	30	3	3	2	1
Oct-03	9	7	30	30	3	3	2	1
Nov-03	9	9	30	30	3	0	2	0
Dec-03	10	10	31	31	3	3	2	1

Table 2-4. Average yearly failure rate for ITS system devices

Device	Failure rate	Comment
Freeway CCTV Cameras	0	
Freeway Sensors	0	
DMS sign Controllers	0.83/ per sign	Communication problems and manufacture controller problems
ATMS software data servers	2 server crashes/month	ATMS software has been on-line for six months. Require UPS upgrade

3. BEFORE AND AFTER SECONDARY CRASHES ANALYSIS

One objective of ITS incident management is to reduce the number and severity of secondary accidents by providing more efficient incident site management and traffic control near and around incident locations. In this section, we identify and analyze secondary accidents along the I-84 corridor prior to and after the installation of ITS devices.

3.1 Before and After Periods

For purposes of this analysis, we define the “before period” as August 1, 2000 to August 29, 2001, when installation of DMS signs was completed. We define August 29, 2001 to September 25, 2002, the period during which CCTV cameras were installed on the freeway, as the “partial deployment period.” We define the “after period” as September 26, 2002 to September 2003 (Figure 3 1).

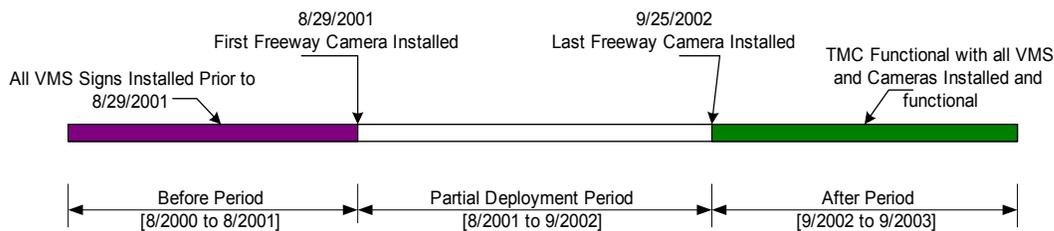


Figure 3 1 Before and After Periods

3.2 Secondary Crashes – Definition and Analysis

For the purpose of this report, secondary accidents are defined according to the following criteria:

- Accidents that occurred within certain time ($t_{\text{secondary}}$) from the time of the initial accident.
- Accidents that occurred within certain distance ($d_{\text{secondary}}$) upstream from the initial accident.
- Accidents that are “rear-end collisions, hit fixed-object or hit other-objects accident when both initial and subsequent accidents occur in the same direction of travel.

- Freeway speed and volume data show continuous incident-related congestion throughout the time $t_{\text{secondary}}$ and the distance $d_{\text{secondary}}$.

Crash data was obtained from both the ITD Incident Response Team logs and the State of Idaho Office of Highway Safety. Freeway volume and speed data, as obtained from ITD ATR stations, was analyzed to verify the secondary crashes. Over all time periods analyzed, twelve secondary crashes were identified (Table 3-1). Results of the analysis are presented in Appendix A, along with a copy of the ITD Incident Response log.

Table 3-1 Potential Secondary Accidents on I-84 Compiled from Incident Response Logs

Date	Initial Accident			Secondary Accident		
	Time	Milepost	East/Westbound	Time	Milepost	East/Westbound
9/13/2000	6:53 AM	51	E	7:55 AM	52	E
1/29/2001	3:37 PM	48	E	5:55 PM	48	E
3/1/2001	6:08 PM	49	E	6:19 PM	50	W
8/15/2001	5:36 PM	49	E	5:41 PM	50	W
9/19/2001	7:00 AM	50	E	7:54 AM	52	E
10/31/2001	7:16 AM	50	E	7:38 AM	50	E
12/18/2001	4:45 PM	48	W	4:51 PM	48	W
2/4/2002	7:54 AM	56	E	7:59 AM	56	E
2/4/2002	5:55 PM	49	W	6:06 PM	49	W
2/14/2002	5:42 PM	48	W	5:54 PM	48	W
3/22/2002	3:25 PM	57	W	3:28 PM	57	W
9/17/2002	4:00 PM	52	W	4:15 PM	51	W

Of the 12 secondary crashes, a total of 4 secondary crashes (an average of 0.25 per month) took place during the 12-month before-period. During the 13-months of partial deployment, there were a total of 7 secondary crashes (0.54 per month), and only one secondary crash occurred during the 12-month after period (0.08 per month).

It was important to determine whether or not statistical evidence would support a significance between the difference of the average number of secondary crashes per month during the before and the number during the after periods. Because of the relatively small sample size, we used the Student's t-distribution test using this test, both before and after data are assumed to be normally distributed with the same standard deviation. The relevant t ratio for testing the difference between two independent means meeting the above conditions is given by:

$$t = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where

s_1 = Standard deviation of the before period

s_2 = Standard deviation of after period

n_1 = Number of months in the before period

n_2 = Number of months in the after period

x_1 = Average number of secondary crashes during the before period, and

x_2 = Average number of secondary crashes during the before period.

Assuming a two-tail 95 percent confidence interval and a normal distribution, the null hypothesis was rejected, indicating that the difference between the before and after is significant. This would lead us to conclude that implementation of the ITS components has a positive impact on the reduction of secondary crashes.

However, we believe that analysis of the data for the 12-month after period may not be sufficient to draw decisive conclusions, and we suggest that additional analysis over a longer period of time is needed before drawing any final conclusions.

Further analysis of the secondary crashes also indicates a significant reduction in severity during both the partial deployment and the after periods. The average crash severity index during the before, partial deployment, and after periods were 3.0, 2.35 and 2.0, respectively. This is consistent with previous research that shows a significant reduction in the severity of secondary crashes as a result of ITS incident management systems.

4. INCIDENT-BASED CONGESTION ANALYSIS

4.1 Introduction

Another objective for deploying ITS systems is to mitigate the impacts of incident-based congestion by implementing an effective incident management system. The ACHD ATMS system attempts to minimize the incident-related network-wide delay by the following actions:

- 1-Reducing the overall incident duration by reducing incident detection, incident response, and incident clearance times,
- 2- Implementing traffic management strategies during the incident and the recovery stages.

To evaluate the effectiveness of the ACHD TMC operations in reducing incident-based delay, we took a simulation-based approach. We developed a CORSIM microscopic simulation model for the Treasure Valley Corridor that was used to model incidents under different scenarios. The network wide delay output from the microscopic simulation model was used to quantify potential delay-reduction benefits that could be achieved by implementing different incident management strategies. This simulation was then compared with the before-after incident congestion index analysis.

4.2 Simulation Model Selection

Several simulation models are available to conduct analyses of arterials or freeways; CORSIM, MITSIM, VISSIM and AIMSUN2 are examples. Some simulations even include origin/destination-based dynamic traffic assignment for modeling diverted vehicles that complete their trips instead of returning to the freeway. But few simulation models have the ability to model both arterials and freeways simultaneously, taking into consideration the effects of one on the other. The FHWA CORSIM microscopic simulation model combines the NETSIM and FRESIM models for arterials and freeways, respectively, allowing for a system-wide analysis of both freeway and its surrounding arterial network. The fact that

CORSIM can reliably model freeway incidents, along with its ability to model integrated freeway and arterial system networks, made it the logical choice to be used in this study.

Due to the relatively complex CORSIM input data process, a decision was made to use SYNCHRO v.5.0 to build the network and then transfer it to CORSIM. One major advantage of using SYNCHRO to build the network is its Windows-based, user-friendly data input interface, which allowed us to build the entire arterial and surface street network in a visually-based program. Another advantage of using SYNCHRO is its ability to import different CAD files as a background. A SYNCHRO file was developed for the arterial and surface-street network from a MicroStation map of the Treasure Valley area.

4.3 Simulation Model Development

Once we determined to use CORSIM as the main simulation model for this study and SYNCHRO to build the network, we placed detectors on the freeway to collect data required for the model development. The Treasure Valley corridor follows Interstate 84 from Milepost 25 to Milepost 60, through the cities of Caldwell, Nampa, Meridian, and Boise. This network covers the entire Boise metropolitan area. The study area consisted of 211 intersections—93 signalized and 118 unsignalized. Of the 211 intersections, 142 are located in Ada County and the remaining 69 are located in Canyon County.

Because the maximum number of nodes allowed in any CORSIM model is 500 nodes, we decided to divide the study area into two separate networks, one for each county. Another set of simulation models, each representing one of the diversion routes identified in the “Interstate Diversion Route Study” report prepared by Six Mile Engineering were also developed and used in the analysis. Figure 4 1 presents the SYNCHRO model for the Ada County arterial network, and Figure 4 2 presents the CORSIM integrated freeway and arterial systems network for Ada County.

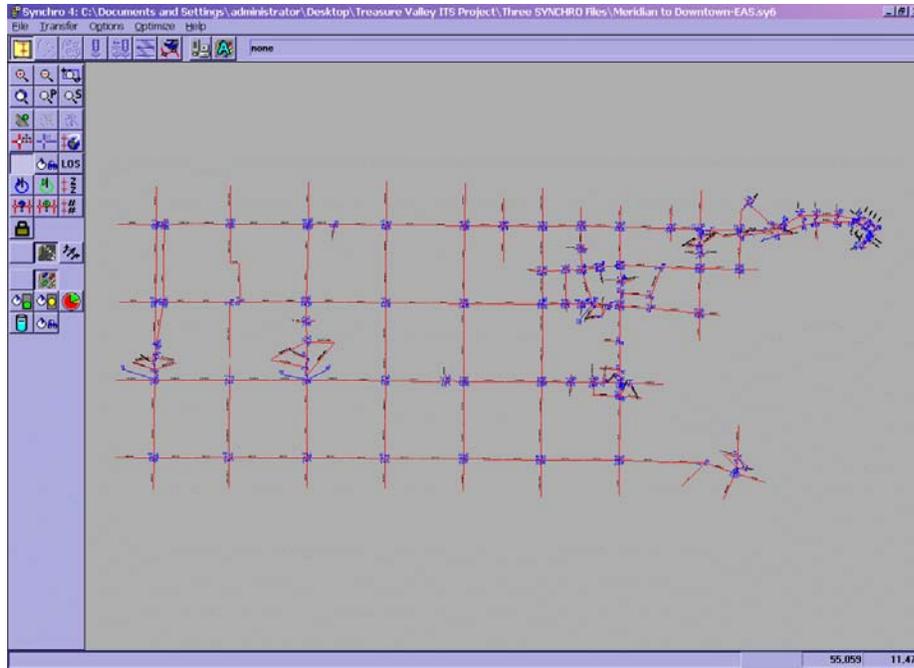


Figure 4 1 SYNCHRO Integrated Freeway/Arterial Systems Model for Ada County.

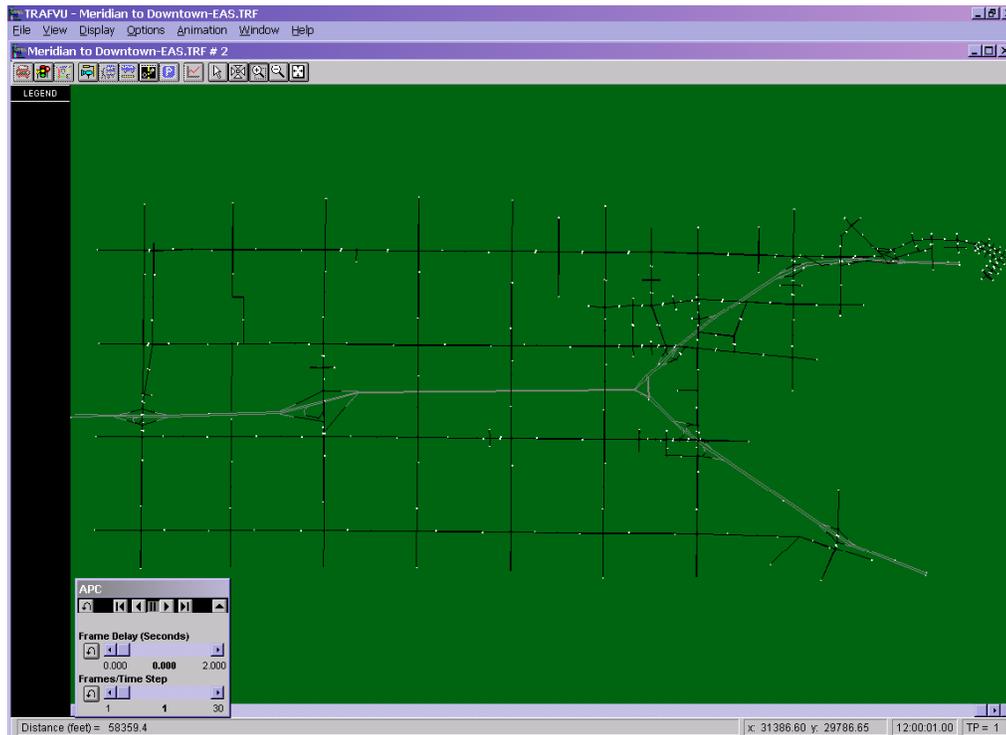


Figure 4 2 CORSIM Integrated Freeway/Arterial Systems Model for Ada County.

4.3.1 Model Validation and Calibration

The CORSIM simulation model is built on a basic set of stochastic algorithms that represents vehicular traffic flow through various types of roadway systems under various conditions. Because of the stochastic nature of simulation programs, their use requires that two basic steps be completed prior to finalizing any analysis results. First, traffic flow characteristics and driver behavior components of the model need to be calibrated to conditions observed or measured in the field. Second, the calibration needs to be linked directly to validation of the model, which involves comparing simulated traffic flows of the system under study with observed traffic flow conditions. This comparison provides a direct measurement of how well results from the model match observed traffic flow conditions.

Considering the extraordinary size of the arterial systems network in the model, we did not have enough data to develop a comprehensive calibration and validation analysis for the arterial systems simulation model. Throughput data, in the form of average hourly volumes, were available for some intersections on the diversion routes. These traffic volumes were used in calibrating the arterial system simulation models for both Ada and Canyon Counties. The difference between the simulated and field volumes ranged from 4 to 13.5 percent, with an average of 8.2 percent. Considering the size of the network and the quality of the traffic and turning movement data available, this relatively high error rate is acceptable, and the results can be used as a basis of comparison with a considerable degree of confidence.

The average detector occupancy was used as the main calibration factor. Traffic volumes on the freeway were chosen to match those reported by the ITD counting stations. Driver behavior characteristics, such as car-following sensitivity factors and percent of different driver types in the traffic were adjusted to reflect the conditions in the field. The difference between the average detector occupancy in the CORSIM simulation and data collected in the field ranged from 3 to 11 percent, with an average value of 7.3 percent. This relatively low difference indicated that the freeway simulation models were validated and could reliably represent the actual traffic conditions in the field.

4.3 Incident-Based Delay Analysis and Results

4.3.1 Incident Management Scenarios

For the purpose of this study the following three incident management (IM) scenarios were examined:

1. Reduction in incident duration.
2. Freeway diversion with no changes to arterial signal timing plans.
3. Freeway diversion with changes to arterial signal timing plans.

A sample size of 20 incidents that occurred on the Treasure Valley corridor was used in the analysis. The incidents used in the study ranged from moderate incidents, with durations of 20 to 40 minutes with partial to full lane closure, to severe incidents, with durations ranging from 40 to 76 minutes with full lane closure.

4.3.2 Evaluation Framework and Signal Timing Optimization Procedure

The integrated microscopic simulation model for the Treasure Valley corridor was used to determine network-wide performance measures under different incident management scenarios. The signal timing plans were developed off-line and optimized to provide maximum throughput of the diversion routes. The performance measure used in this study is the relative percentage reduction in network-wide total travel time, which is defined as following:

$$P_i = \left(\frac{TTT_{DoNothing} - TTT_{Diversion}}{TTT_{DoNothing} - TTT_{NoIncident}} \right),$$

where

- P_i is the relative reduction in network-wide total travel time for diversion plan i [$0 \leq P_i \leq 1$]
- $TTT_{DoNothing}$ is the network-wide total travel time under the incident with no diversion plans
- $TTT_{Diversion}$ is the network-wide total travel time under the incident with diversion plans
- $TTT_{NoIncident}$ is the network-wide total travel time under no incident

This measure takes into account the traffic operation during the no-incident situation, presenting a relative measure of the effectiveness of incident scenarios under different traffic demand levels. The procedure used to evaluate and optimize the arterial signal timing plans is presented in Figure 4 3.

We also evaluated alternative signal timing plans for the corridors with cycle lengths ranging from 180 seconds to 240 seconds. ACHD has developed signal timing plans for many diversion routes using this range of cycle lengths.

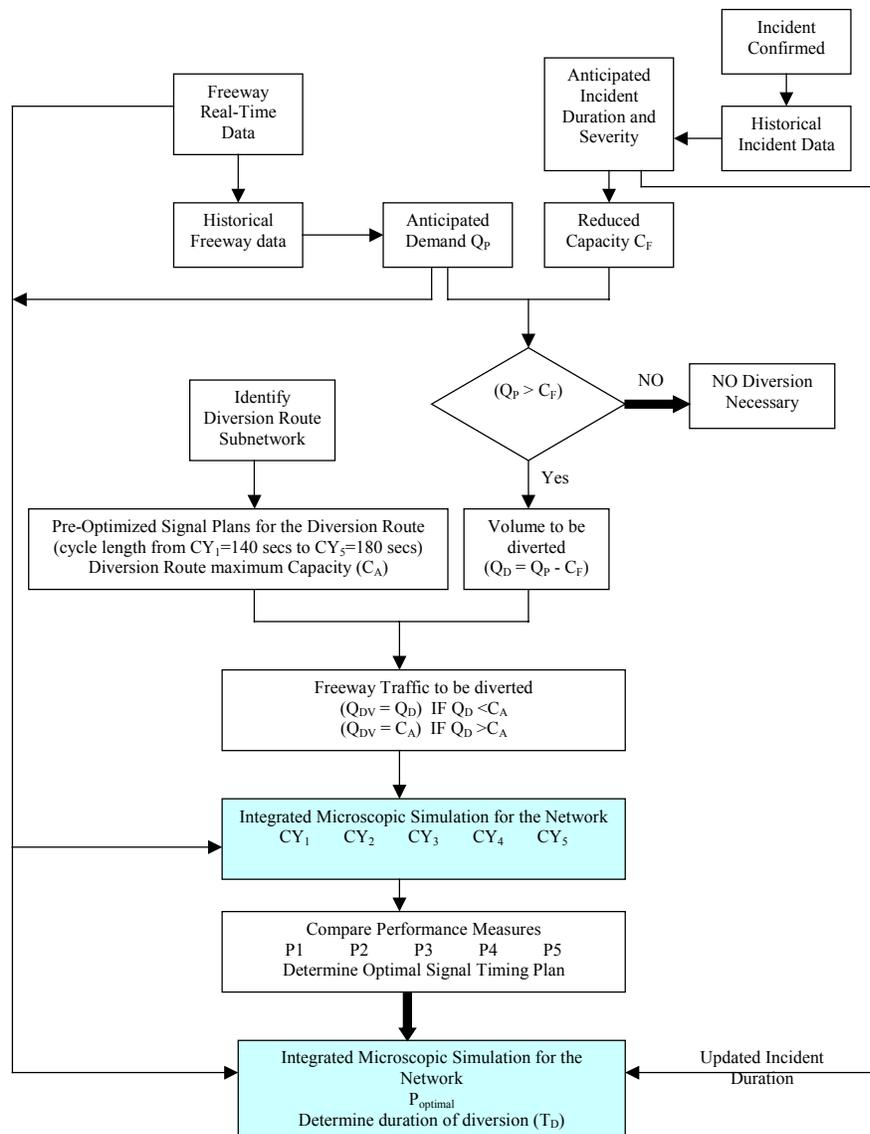


Figure 4 3 Procedure Used to Evaluate and Optimize Arterial Signal Timing Plans

4.3.3 Quantifying Potential Delay Reduction Benefit

Many evaluation studies have showed that ATMS systems with extensive CCTV coverage reduce incident detection and verification times. These studies also show that efficient coordination between different agencies responding to incidents reduces the duration of the incident clearance time.

4.3.3.1 Case 1-Reduction in Incident Duration

The reduction in incident duration depends on many factors but primarily on the characteristics and nature of the incident itself. For our analysis, a random sample of 20 incidents with different severity and traffic demand levels was used. We assumed that these incidents represented a random sample of the all incidents that occurred on the Treasure valley corridor during the study period. Each of the incidents was modeled using the CORSIM model under the following ten different scenarios:

- One scenario with no incident,
- One actual reported incident duration, and
- Eight hypothetical reductions in incident duration ranging from 2 to 16 percent.

Traffic demand levels were obtained from ITD ATR stations' data. To account for the stochastic variation of traffic, 20 multiple simulation runs were executed for each case, for a total 4000 runs.

The reduction in incident duration and the average relative reduction in total travel time P_i is defined in this part of the study as:

$$P_i = \left(\frac{TTT_{ActualIncidentDuration} - TTT_{ReductionInIncidentDuration}}{TTT_{ActualIncidentDuration} - TTT_{NoIncident}} \right).$$

We chose a hypothetical incident reduction range of 0 to 16 percent, which is consistent with the reduction in most incident duration reported by incident management systems' evaluation studies. Figure 4 4 illustrates that the relative total travel time should decrease as the reduction in incident duration increases. The reduction in relative total travel time ranges from 2.31 to 8.52 percent. With a 10 percent reduction in incident duration, it appears that an

average of 4 percent reduction in relative total travel time could be achieved. This percentage corresponds to an average reduction of 8.7 percent of network total travel time.

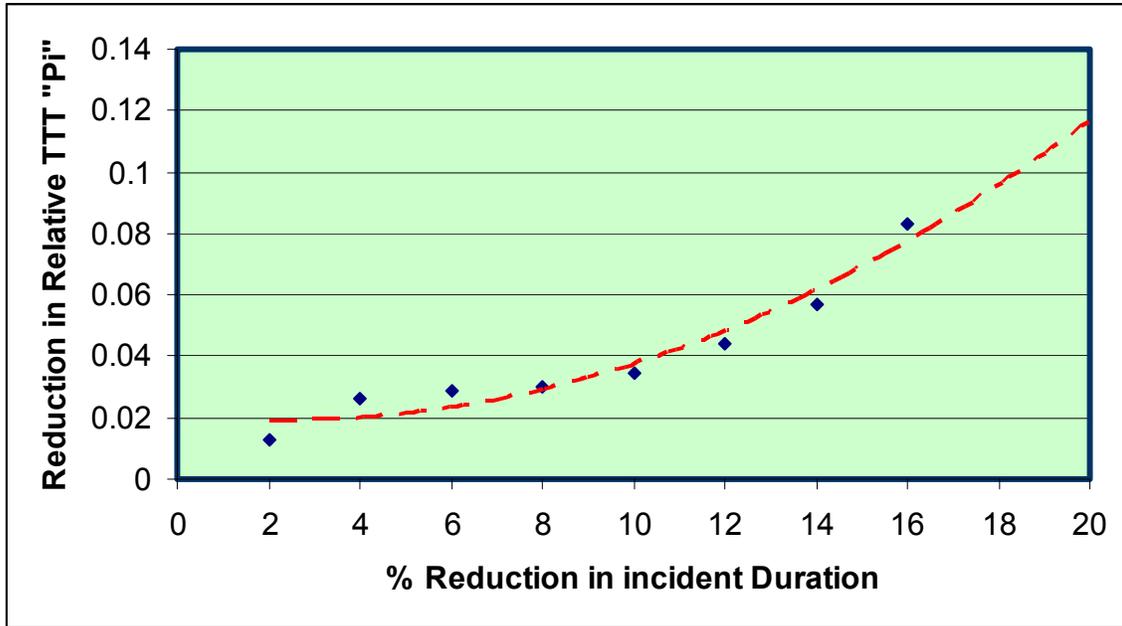


Figure 4.4 Average Reduction in Relative Total Travel Time Due to Reduction in Incident Duration.

4.3.3.2 Case 2-Diversion of Freeway Traffic to the Arterial System Network

The network-wide delay reduction benefit that results from implementing freeway diversion plans will depend on several factors, such as the severity of the incident, incident duration, freeway traffic demand levels, the extra-capacity available in the surface street network, and the percent of freeway drivers who chose to exit the freeway and enter the surface street network. An optimal network-wide balance could be achieved if the diverted traffic is comparable to the surface street extra-capacity available. There are, however, several uncertainties associated with incidents that affect the incident management operations.

In addition to the uncertainty in incident duration, there is no effective way in practice to achieve a theoretical optimum diversion from an open freeway. Drivers can be allowed to make their own choices based on the advisory messages disseminated to them through traveler information systems, such as DMS and radio broadcast (uncontrolled and elective

diversion). Alternatively, drivers can be forced to divert by closing a lane and forcing them to exit or by closing a facility and forcing all drivers to exit. Although IM strategies can encourage drivers to adjust routes, transportation professionals have very little control over the number of drivers who actually divert. Furthermore, the routing of vehicles that are diverted cannot be accurately predicted. Not all diverted vehicles will return to the freeway; some will complete their trip on the arterial network once they have been diverted from the freeway. Some vehicles that are willing to divert may pursue routes other than the designated diversion routes to complete their trip.

We used the calibrated simulation models for the Treasure Valley corridor to examine the potential network-wide delay reduction benefits that could be achieved through diverting some of the freeway traffic to the surface-street network during incident situation. Actual incident duration and traffic demand on the freeway and surface street network were used in the analysis. For this part of the analysis, no changes were made to the signal timing plans on the arterials.

In general, the results show that the relative percent reduction of total travel time (TTT) as a result of freeway diversion route plans is much higher for incidents that have moderate severity and/or duration. The relative reduction in TTT for this part of the analysis was calculated using the following equation:

$$P_i = \left(\frac{TTT_{DoNothing} - TTT_{Diversion}}{TTT_{DoNothing} - TTT_{NoIncident}} \right).$$

The average reduction on relative network-wide TTT for the 20 incidents used as sample in this study is presented in Figure 4 5. The figure shows that the average reduction in TTT for different driver compliance ratios ranges from 0 to 50 percent. An optimal compliance rate that ranges from 30 to 35 percent would provide the optimal savings in network-wide total travel time. This percentage seems to be compatible with the extra-capacity available in the Treasure Valley surface street network. Important to note is that when the percentage of diverted vehicles exceeds 35 percent, the delay in the surface street network increases, reducing the network-wide delay reduction benefits.

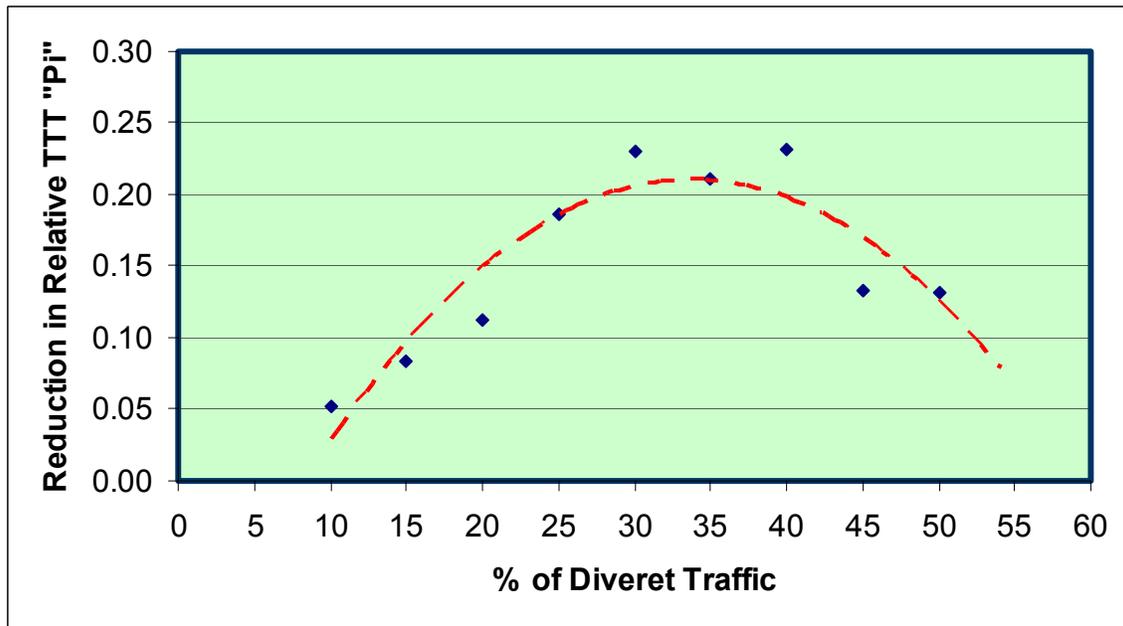


Figure 4 5 Average Reduction in Relative Total Travel Time Due to Freeway Diversion.

4.3.3.3 Case 3-Diversion of Freeway Traffic with Signal Timing Modification

The third set of simulations for the Treasure Valley corridor examined the potential network-wide delay reduction benefits that could be achieved by diverting some of the freeway traffic to the surface-street network by modifying signal timing. Optimal signal timing plans for the surface street network were simulated using PASSER II-90 and TRANSYT signal optimization models. The plans were developed to optimize the throughput of the network. Alternative optimal signal timing plans were developed for each demand level with cycle length ranging from 180 seconds to 240 seconds. Finally, the optimal plan was identified using the procedure described in section 4.3.2.

We concluded that the most benefit could be achieved from signal timing modification with a freeway diversion rate of 15 to 35 percent Figure 4 6). Changing the signal timing had no significant impact when the level of diverted traffic was lower or higher than that range. When the level of diverted traffic is lower, there is no need to increase the capacity on the diversion routes, since the extra-capacity under the existing timing plans was sufficient to

accommodate the diverted traffic. When the percentage of diverted traffic was higher, signal timing plan modifications were unable to increase the capacity on the diversion routes to a level at which they could accommodate the larger volume.

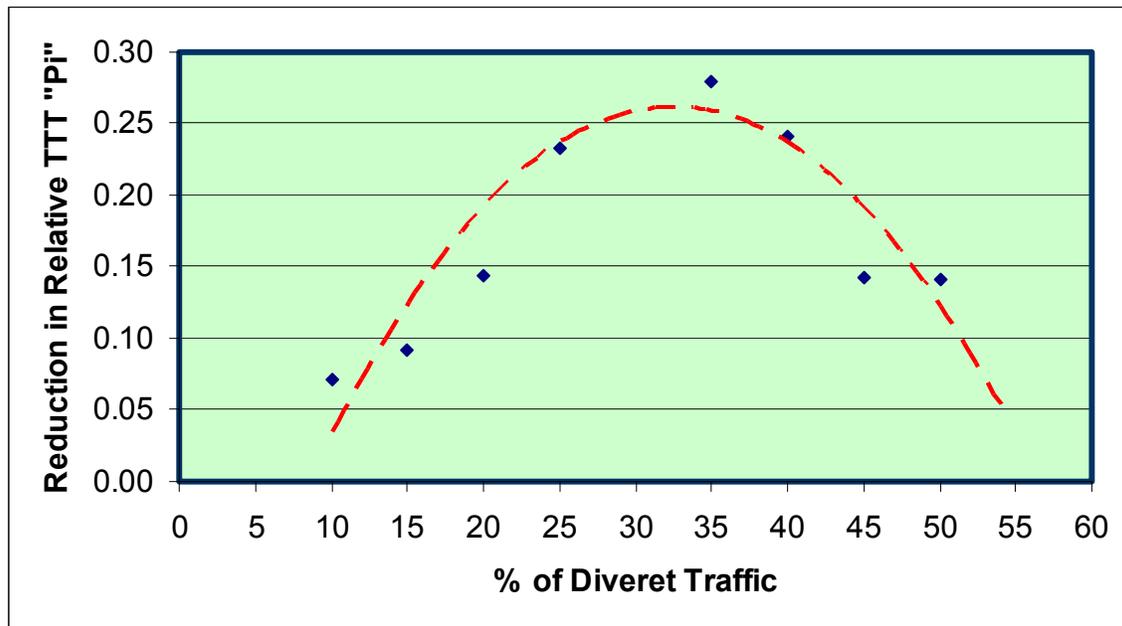


Figure 4 6 Average Reduction in Relative Total Travel Time Due to Freeway Diversion and Signal Timing Modifications.

4.4 Before/After Congestion Index Analysis

4.4.1 Incident-Based Congestion

This section presents the results of a before/after analysis of incident-based congestion on the freeway using the ATR speed and volume data collected throughout the duration of this study. We considered only morning and afternoon peak periods since these are the times when incidents would have a major impact on the freeway operation characteristics. For this part of our analysis, the start of incident-based congestion at any station and at any given time was flagged if the speed of that particular minute and the previous three minutes were below the speed threshold value of 35 miles per hour. The speed of 35 mph was chosen because it is below the level of recurring congestion reported in all ATR stations. We defined the before and after periods as in Section 3 (Figure 3 1).

4.4.2 Incident-Based Congestion Index Analysis

A station incident-based congestion index, a measure of the time a station is congested due to incidents, was developed and used in to complete the analysis. The station incident-based congestion index (STIBCI) was calculated using the equation

$$STIBCI_n = \frac{CM}{TM},$$

where

STIBCI_n is the station incident-based congestion index during day n

CM is the length in minutes of congested period at the station

TM is the length in minutes of the observation period at the station.

NIATT ATR analysis tool (Fig. 2-2) was used to analyze ATR data for ten stations located along a 10.8 mile segment on I-84 between milepost 47.93 and milepost 58.73. The STIBCI was computed for each of the ten stations for each day during the before and after periods. Days with missing or incomplete data were excluded from the analysis.

For our analysis, we assumed that the duration of the before and after periods were long enough to provide data for two independent populations, which then provides a valid before and after statistical analysis. Because of the randomness of incident occurrence and the two-mile average spacing between ATR stations, the duration of the before and after periods may not be enough to provide two full independent representative populations. However, this analysis does represent incident-based congestion on the corridor.

In 7 out of the 10 stations, the after STIBCI was lower than that it was during the before period. The reduction in STIBCI ranged from 1 to 18 percent. For the 3 stations where the STIBCI values were higher during the after period, the average increase in STIBCI ranged from 5 to 33 percent. The overall average reduction in the STIBCI for all stations in the examined segment of the freeway was 1.3 percent (Table 4-1)

To determine if there was sufficient statistical evidence to show that the average values of STIBCI during the before and after periods were different, the Student's t-distribution test was used. Again, we used this test because of the relatively small sample size. Both before and after data are assumed to be normally distributed and have the same standard deviation. Assuming a two-tail, 95 percent confidence interval and a normal distribution, the null hypothesis was rejected, indicating that the difference between the before and after data was not statistically significant. However, we recommend that a larger sample be studied to verify these figures.

Table 4-1 Before and After STIBCI Values

Station	Average STIBCI (before)*	Average STIBCI (after)*	Sample Size (Days)
121	11.22	9.65	321
260	8.54	11.40	287
261	9.43	7.66	343
265 (EB)	13.25	11.56	266
002 (EB)	12.49	13.11	241
002 (WB)	7.03	8.76	306
265 (WB)	11.09	10.44	321
262	7.81	7.74	296
263	10.65	8.96	311
122	14.55	13.38	322

* multiplied by 1000

5. BEFORE AND AFTER INCIDENT DURATION ANALYSIS

The objective of this part of our study was to determine whether or not the ITS deployment had a measurable impact on the incident clearance times. If the ITS deployment did have a measurable impact on managing incidents, the mean clearance times for the before and after deployment periods would be different. Such an analysis of comparison of mean clearance times can be done for the aggregate mean clearance time between analysis periods or for the mean clearance times for a season within analysis periods. If the analysis for seasonal mean times is done, it should be done for the same season. Comparing data from the fall for a period with the winter season from another period would have other uncontrolled factors that would invalidate the analysis.

5.1 Methodology

We reviewed the incident response logs maintained by the ITD emergency response teams for peak hours during weekdays, and the data pertaining to incidents was transferred to a spreadsheet file. We computed sample means and standard deviations of incident duration for the three periods and for four seasons within the three time frames. We considered using individual months rather than four seasons, but because of low number of observations for some of the months, this idea was dropped in favor of aggregating three months comprising different seasons of the year. The months of September, October and November were considered to be the fall season and subsequent three-month periods comprised the winter, spring and summer seasons.

5.2 Comparison of Mean Incident Clearance Times

Table 5-2 shows the mean incident clearance time for incidents for various time periods. Sample standard deviations of the response times are also shown. All numbers, except the row corresponding to statistic n , denote time in minutes. The numbers for rows corresponding to the statistic n are the number of observations.

Table 5-1 Summary Results with Correct Aggregate Standard Deviations

Period	Statistic	Fall	Winter	Spring	Summer	Aggregate
Before deployment	Mean	36.4	24.92	25.68	33.73	29.84
	Std.Dev.	40.07	21.35	18.07	40.13	31.37
	n	15	23	32	38	
Partial deployment	Mean	29.8	32.57	34.62	37.78	33.43
	Std.Dev.	29.75	47.97	31.33	33.82	35.23
	n	51	34	45	37	
After deployment	Mean	32.58	35.62	31.52	29.93	31.95
	Std.Dev.	22.7	26.93	32.08	27.72	27.47
	n	31	26	33	50	

(n = number, all other units in minutes)

5.2.1 Testing of Equality of Variances

The analysis for the aggregate mean clearance time was completed first. The first step in the analysis was to compute the ratio of variances of clearance times for the before and after deployment periods. This ratio, denoted by θ , was found to be equal to 1.304. The statistic θ is F-distributed with degrees of freedom, $v_1 = 107$ and $v_2 = 139$. The critical values for the F distribution were then found at the 5 percent level of significance, they were: 0.77 and 1.25. Since the computed value of θ lies outside this interval, we reject the hypothesis that the variances are equal at the 5 percent level of significance.

5.2.2. Comparing Means from Independent Populations with Unequal Variances

The data sets from analysis the before and after deployment periods constitute two independent populations. We found above that the two populations have unequal variances and that the mean clearance time did not decrease between periods I and III. Now we will test whether or not there is any statistical difference in the two means.

The statistical test reveals that the hypothesis that the two mean clearance times are equal cannot be rejected at the 5 percent level of significance. This implies that the data we have does not indicate that the incident clearance times have decreased due to the deployment of ITS in the Treasure Valley.

This was not a surprising fact when presented to ACHD. The incident management operation plans have not yet been formalized by all agencies within the Treasure Valley.

The project team feels there will need to be a coordinated effort between all Treasure Valley agencies before a reduction in clearance times can be achieved. The installation of ITS devices and the development of an incident management plan are only the first steps in a much larger process.

6 INCIDENT MANAGEMENT SOFTWARE PROCUREMENT PROCESS

This chapter presents a description of the ACHD incident management software procurement process. The initial phase of this task, conducted by Transcore, ACHD, ITD, Boise State University and NIATT, was to investigate incident management software packages currently being used by other agencies across the U.S. The options were either to identify and buy an incident management package for the Treasure Valley or to have the University of Idaho develop a software for the Treasure Valley. After reviewing other agencies' ATMS systems and recognizing the complexity of software packages, the project team determined that the best option was to purchase an off-the-shelf ATMS software package. Once this decision was made, the project team proceeded to the next task, which involved defining the functional requirements and specifications for the incident management software.

6.1 Incident Management Software Functional Requirements

The first step in the process of defining the software requirements involved reviewing the operation of existing incident management software packages. During a week-long scanning tour, the project team visited traffic management centers in five different cities to review and evaluate the operations of the ATMS software at these centers. The five cities were: Salt Lake City, Utah, Albany, New York, Atlanta, Georgia, Milwaukee, Wisconsin and Colorado Springs, Colorado.. The following 14 general functionalities were examined at each location, the full scanning tour questions and functionality is presented in Appendix B:

1. **Case Study** – What is the scenario the system is being used in at this site? Does it approximate the Treasure Valley? What are the important differences and similarities?
2. **Software** – What functionality belongs to the native software and what is integrated from other applications?
3. **Communications** – What type of communications are used at this site to run the system? What impact does this have on system performance?
4. **General** – What are the overall good/bad aspects of the software package?
5. **User Interface** – What elements of the UI do you like/dislike? Is the content and functionality intuitive on the individual screens?

6. **System Map** – Does the map provide the appropriate level of information in a usable manner?
7. **Detection System** – What level of detection system control is available from the software UI? What functions do you like/dislike?
8. **Camera Control System** – What level of camera and video control is available from the software UI? What functions do you like/dislike?
9. **Sign Control System** – What level of sign and message control is available from the software UI? What functions do you like/dislike?
10. **Incident Management** – Does the software provide for incident tracking and automated response plans, and how is it accomplished?
11. **Traveler Information** – What ATIS functionality is supported or may be integrated into the software package?
12. **Reporting** – How flexible is the software for providing system-based reports and data?
13. **Administration** – What level of access and configuration is available to system administrators?
14. **Signals** – Does the software support signal operations or does it provide for future integration of such control?

The scanning tour served as a very effective tool to help the project team identify different issues involved in the various stages of acquiring, operating and maintaining ATMS software. By the end of the tour, the project team had developed a list of the requirements for different system functionalities for the Treasure Valley ATMS software. These lists were used by the project team to procure a Treasure Valley ATMS software specifications document. This “request for proposals” document was sent out to 18 firms as the part of the FY00 ITS Earmark project. An evaluation of this FY00 ITS project will be completed in 2005.

7 EVALUATION OF INSTITUTIONAL COOPERATION

7.1 Institutional Cooperation between Agencies Involved

This chapter summarizes our evaluation of the nature of institutional cooperation between different agencies involved in completing all project tasks. We collected the data via phone interviews with representatives of different agencies involved in the project including project consultants, emergency responders, planning agencies and local and state transportation agencies. One of the challenges in conducting this part of the analysis was the unavailability of representatives of some agencies due to a variety of reasons. Due to the delay in project deployment, some of the staff members that were involved in the planning and early deployment stages were not available during the evaluation phase of the project.

A total of 11 interviews were conducted with that lasted from 10 minutes to 20 minutes. The following questions were used in the interviews:

1. Was your agency involved in the project planning stage?
2. Were the needs of your agency identified and considered?
3. In your opinion, were the needs of all the agencies considered and valued appropriately in the planning?
4. Will your Agency benefit from the deployment?
5. Did your agency provide any funds for the project deployment?
6. Will the operation of your agency change as a result of the project implementation?
7. Do you have a direct communication link with the ACHD Traffic Management Center?
8. Do you share information with ACHD?
9. From your agency's prospective, what is the most important component of the ITS deployment?
10. What are the positive things you see in the ITS deployment?
11. What are the negative things you see in the deployment?
12. How would you evaluate the institutional cooperation between the different agencies?
13. Anything else to add?

Appendix C summarizes the phone-interviews with representatives of different agencies.

7.2 Survey Results and Issues Raised

Personnel from all agencies indicated that they were involved in the project planning stage and that their needs, as well as the needs of other agencies, were identified and considered appropriately. Some interviewees indicated that they were involved in early stages only and suggested that the need-identification process for different agencies might have been determined using a more formal process. One of the comments was that consideration of future expansion and growth of the network should have been part of the need-identification process.

Personnel from all agencies surveyed, including agencies that did not contribute funds to the project, indicated that they expected their agencies to benefit directly from the project deployment. When asked about the most important component in the deployment project, the following components were identified:

1. CCTV
2. Fiber optics communication network
3. Incident Management Plan
4. Incident detection and verification
5. Improved traffic data collection
6. New agency partnerships

When asked about the positives of the deployment project, personnel interviewed identified developing the IMP and sharing it with the cities and police department as positive. Other positives identified were

1. Faster incident detection and response
2. Improved communication between agencies involved
3. Better informed public about traffic conditions
4. Improved travel conditions for the public
5. Ability to share video and data information among different agencies

When asked about the negatives of the deployment project, personnel from agencies said that some agencies are still adjusting their operations and some still need to be convinced that the ITS deployment is a positive change. Other negatives identified were

1. The period of planning was too lengthy
2. Better communications could have helped avoid errors that occurred
3. The project could have been better integrated
4. Better ways of responding to emergencies could have been identified
5. TMC location contributed to the increased cost of the project
6. The project might have been marketed better in the beginning stages

When asked to evaluate the institutional cooperation between the different agencies, the respondent evaluations ranged from good to excellent. Some specific comments were

1. Everyone got a long pretty good; noticed people working [together] better in Idaho than in other places
2. Excellent cooperation; phenomenal team work
3. Everyone was very courteous and got along great
4. It was pretty good, although there were some partners that could have done more to be involved; ITD stood on the sidelines a little too much
5. Not so good at the beginning, but at the end it was good but not excellent.
6. Overall agencies cooperated well
7. Good, but could have been better.
8. Some mistrust and personality quirks surfaced between some of the representatives of the agencies involved

The following general comments were also made:

1. Project was a success, everything ran smoothly
2. Additional stake holders always tend to appear after a system is deployed
3. It is unique for a county to maintain and operate a system on a state highway
4. The Project Manager did an excellent job managing the project and so has everyone else
5. Key players on all the different agencies already knew each other
6. Would like to see a more seamless system that does not differentiate between state and local routes
7. ISP never sent the same person to the meetings which made communication difficult

8. Very successful project, fairly low cost compared to other ITS projects.

8 CONCLUSION AND LESSONS LEARNED

Results of a self evaluation study for the ITS deployment project for the Ada County Highway District were presented in this report. A before-and-after secondary crash analysis was conducted to examine the safety impacts of the ITS deployment projects. Results of the analysis indicated that the difference between the before and after secondary crashes is significant. This would lead us to conclude that implementation of the ITS components has a positive impact on the reduction of secondary crashes. However, we believe that analysis of the data for the 12-month period may not be sufficient to draw decisive conclusions and we suggest that additional analysis over a longer period of time is needed before drawing any final conclusions.

Further analysis of the secondary crashes also indicates a significant reduction in the severity of the crashes during both the partial deployment and the after periods. The average crash severity index during the before, partial deployment, and after periods were 3.0, 2.35, and 2.0, respectively. This is consistent with previous research that showed a significant reduction in the severity of secondary crashes as a result of ITS incident management systems.

A simulation-based study was used to evaluate and quantify the potential delay reduction benefits that might result from the ITS deployment project. An integrated simulation model for the Treasure Valley corridor was used in the analysis. Three incident management (IM) scenarios were examined in the analysis: 1) reduction in incident duration, 2) freeway diversion with no changes to arterial signal timing plans, and 3) freeway diversion with changes to arterial signal timing plans. Results indicated that the reduction in relative total travel time ranges from 2.31 to 8.52 percent. With a 10 percent reduction in incident duration, it appears that an average of 4 percent reduction in relative total travel time could be achieved. This percentage corresponds to an average reduction of 8.7 percent of network total travel time.

When freeway diversion plans were employed, results indicated that an optimal driver compliance rate that ranges from 30 to 35 percent would provide the optimal savings in network-wide total travel time. This percentage seems to be compatible with the extra-capacity available in the Treasure Valley surface street network. The study showed that when the percentage of diverted vehicles exceeds 35 percent, the delay in the surface street network increases, reducing the network-wide delay reduction benefits.

The study also indicated that the most benefit could be achieved from both signal timing modifications and freeway diversion route plans were employed. When the level of diverted traffic is lower, there is no need to increase the capacity on the diversion routes, since the extra-capacity under the existing timing plans were sufficient to accommodate the diverted traffic. When the percentage of diverted traffic was higher, signal timing plan modifications were unable to increase the capacity on the diversion routes to a level at which they could accommodate the larger volume.

A before-and-after incident congestion index analysis showed that the difference between the before and after data was not statistically significant. However, we recommend that a larger sample be studied to verify these figures. A before-and-after incident duration study yielded similar results. This was not a surprising fact as the incident management operation plans have not yet been formalized by all agencies within the Treasure Valley.

The project team feels a coordinated effort between all Treasure Valley agencies is needed before a reduction in clearance times can be achieved. The installation of ITS devices and the development of an incident management plan are only the first steps in a much larger process.

The project team interviewed representatives from different agencies involved in the project. A review of the institutional cooperation between different agencies involved in the project revealed a positive cooperation between different agencies involved during the planning, implementation and operation phases.

APPENDIX A: SECONDARY CRASH ANALYSIS

September 13, 2000

Figure A-1. Traffic Volumes for Site 261 on 9/13/00.

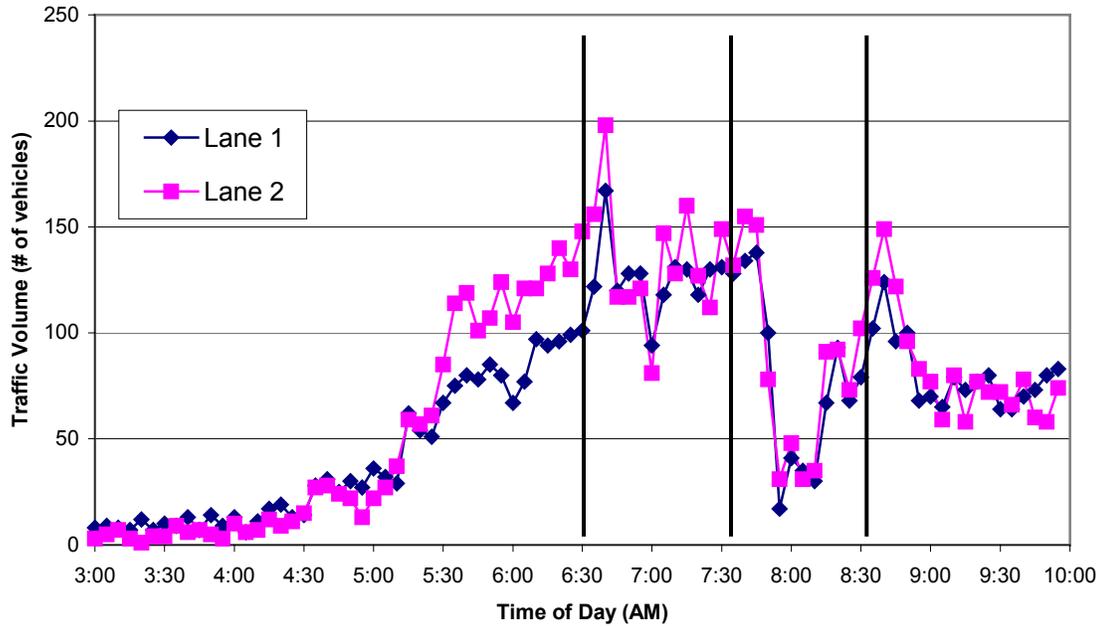


Figure A-2. Traffic Volumes for Site 265 (Lanes 1 and 2) on 9/13/00.

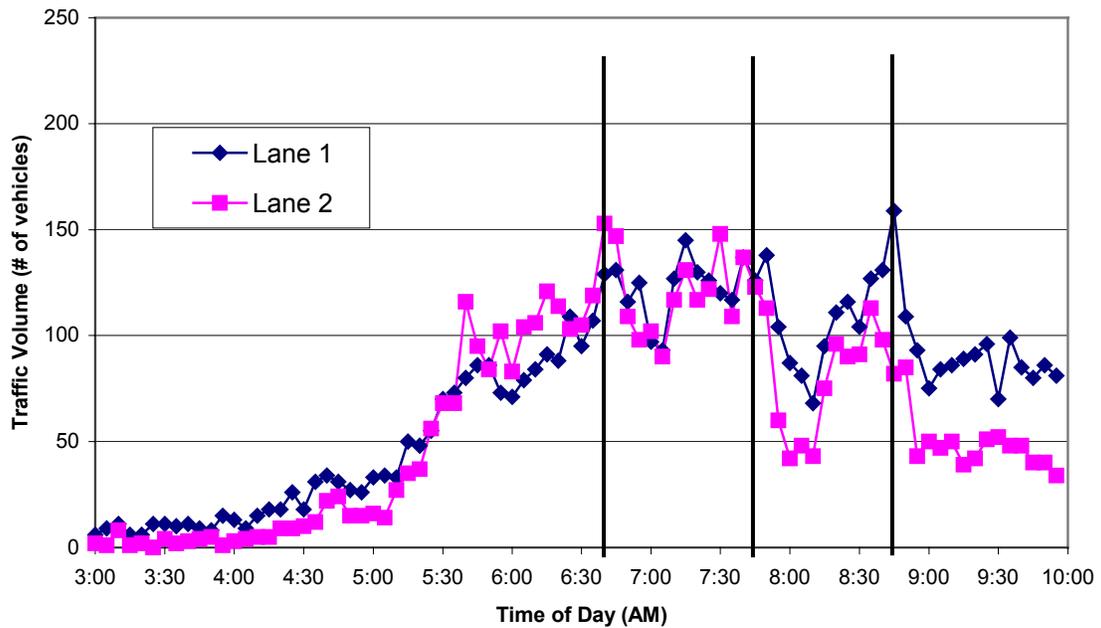
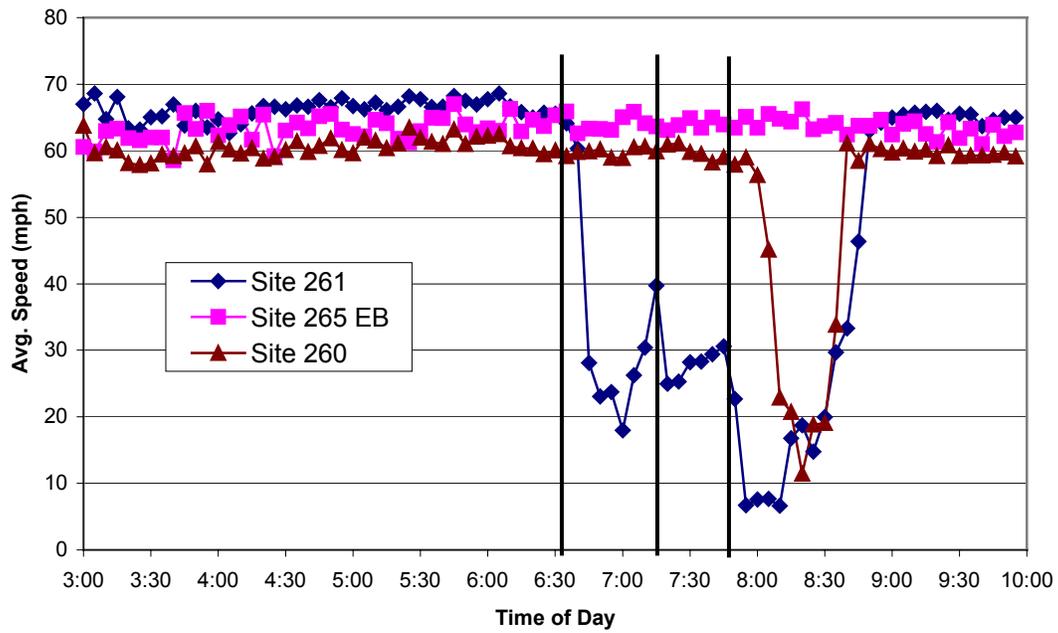


Figure A-3. Average Speeds for Sites 261, 265 EB, and 260 on 9/13/00.



January 29, 2001

Figure A-4. Traffic Volumes for Site 263 on 1/29/01.

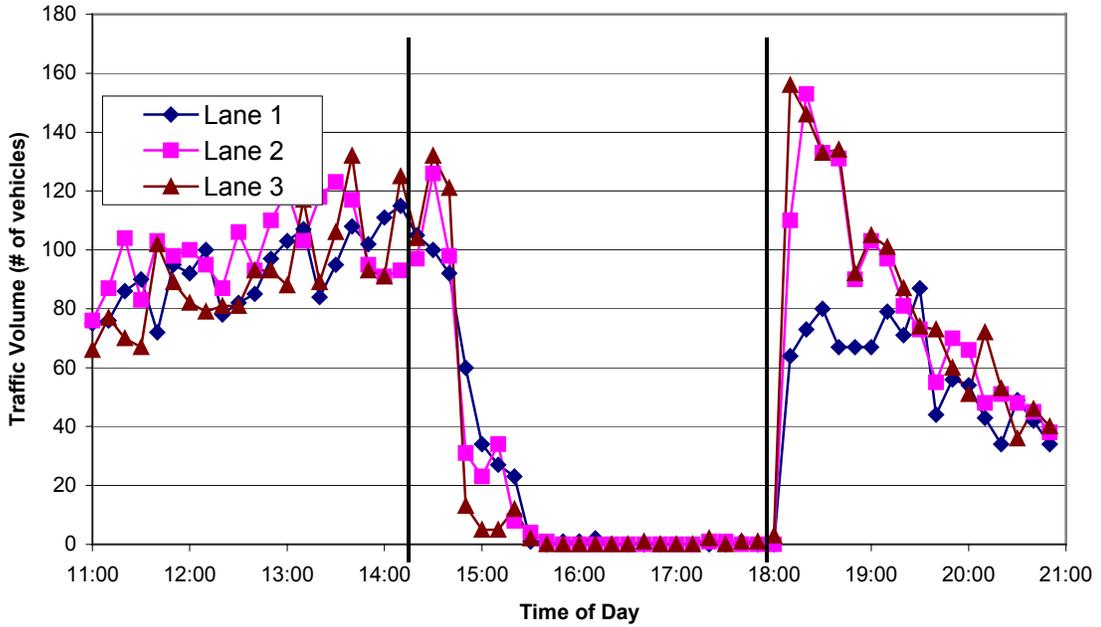


Figure A-5. Traffic Volumes for Site 122 on 1/29/01.

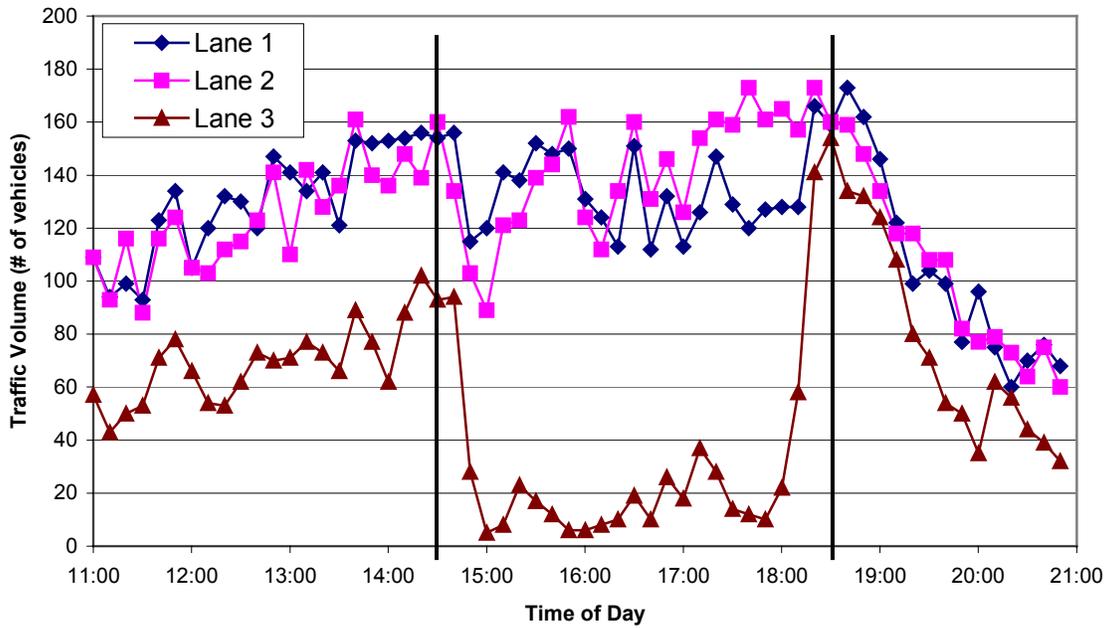


Figure A-6. Traffic Volumes for Site 262 on 1/29/01.

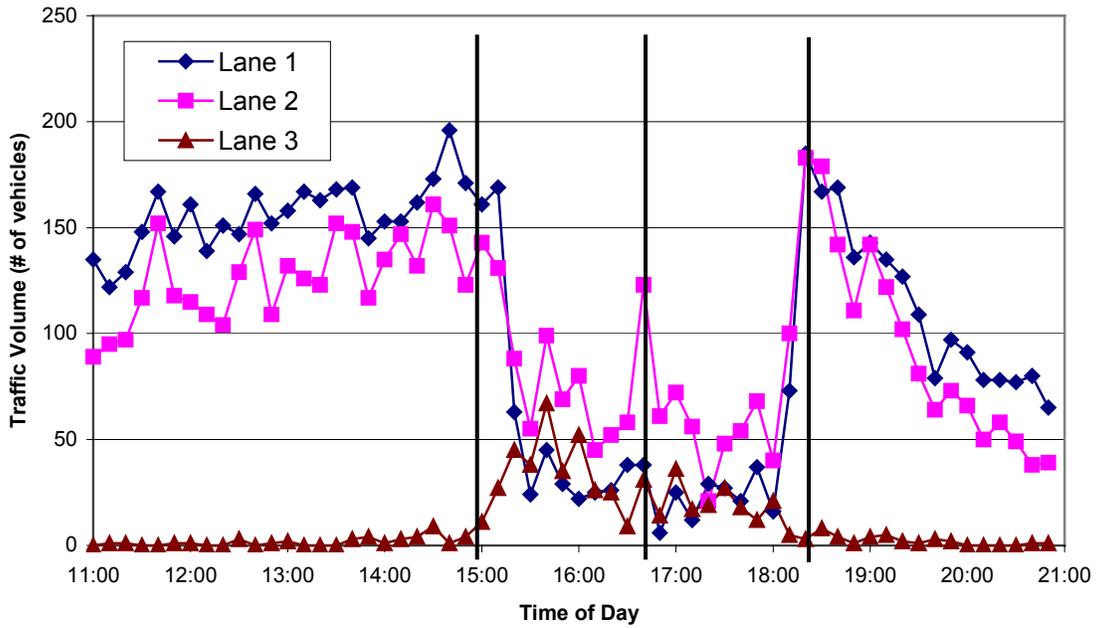
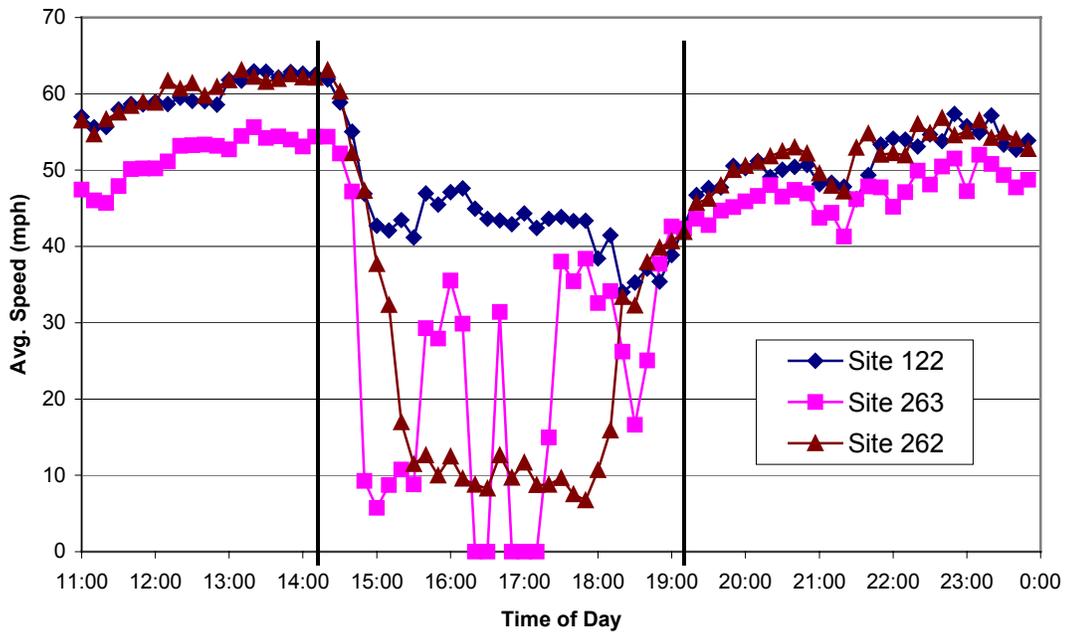


Figure A-7. Average Speeds for Sites 122, 263, and 262 on 1/29/01



August 15, 2001

Figure A-8. Traffic Volumes for Sites 263 on 8/15/01.

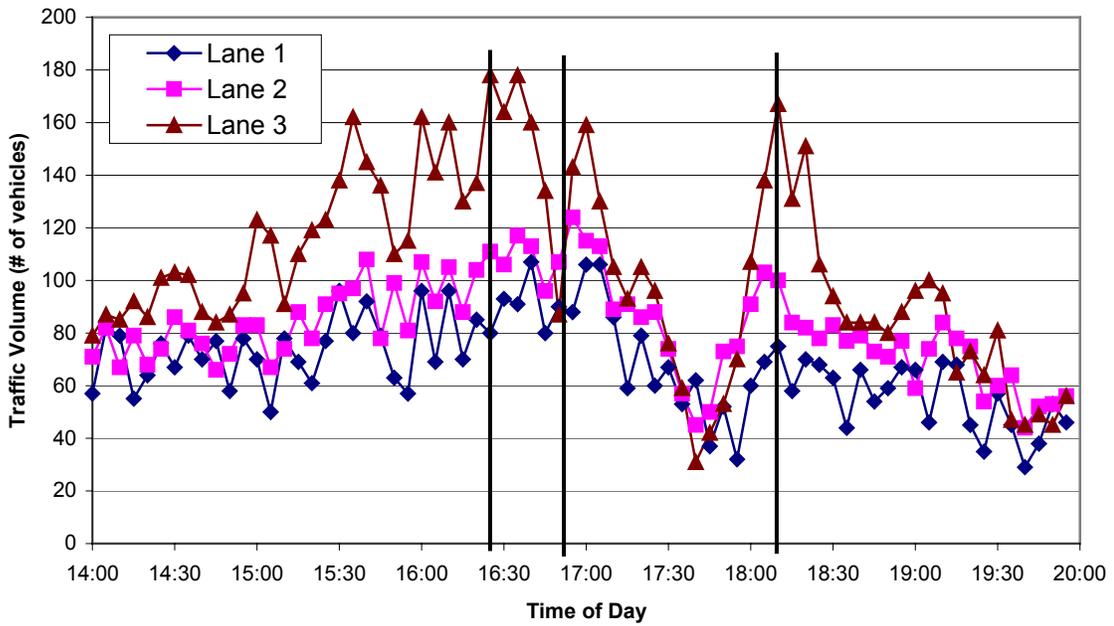


Figure A-9. Traffic Volumes for Sites 262 on 8/15/01.

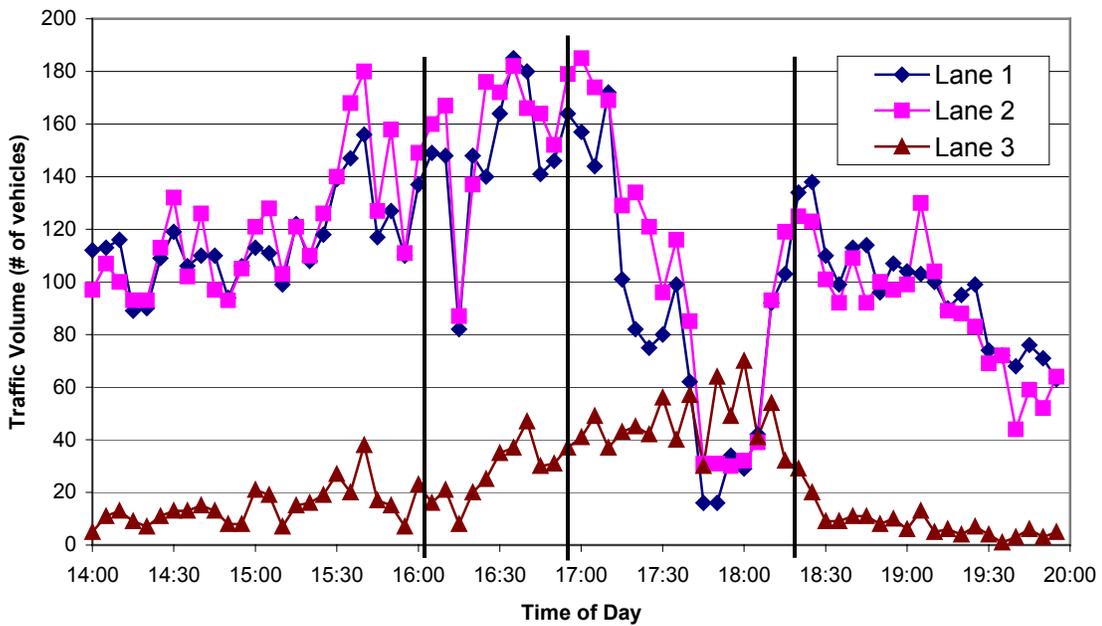
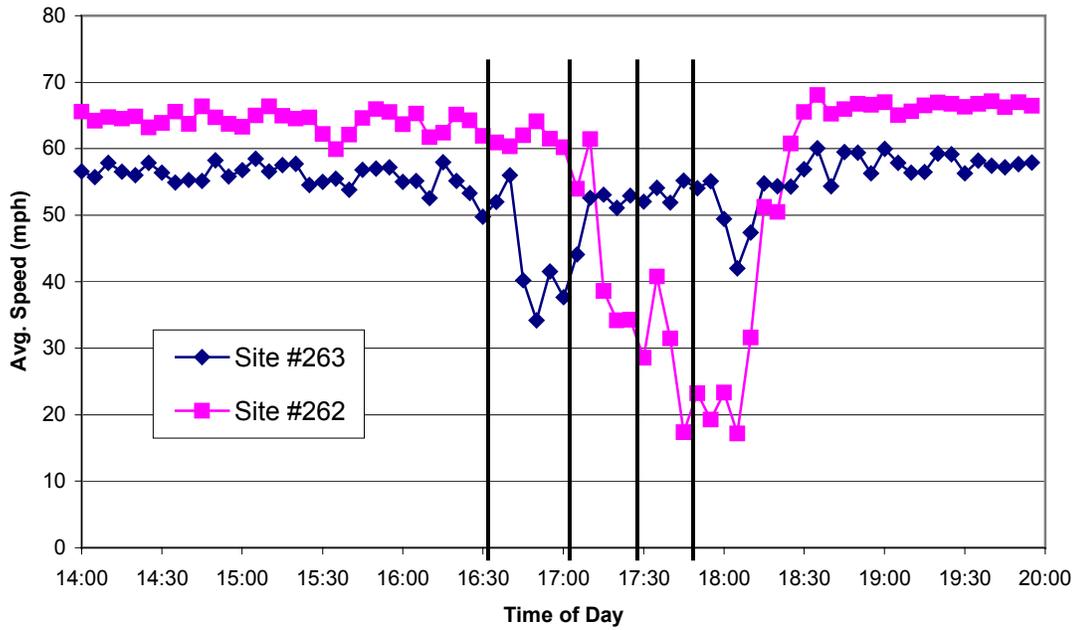


Figure A-10. Average Speeds for Sites 263 and 262 on 8/15/01



September 19, 2001

Figure A-11. Traffic Volume Plot for Site 261 on 9/19/01.

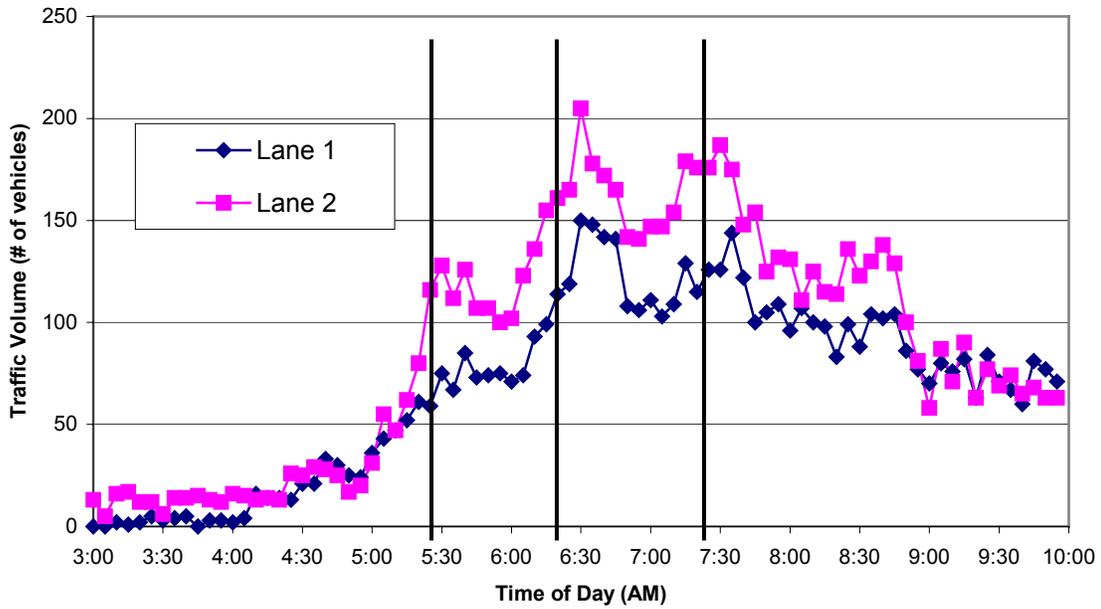


Figure A-12. Traffic Volume for Site 260 on 9/19/01.

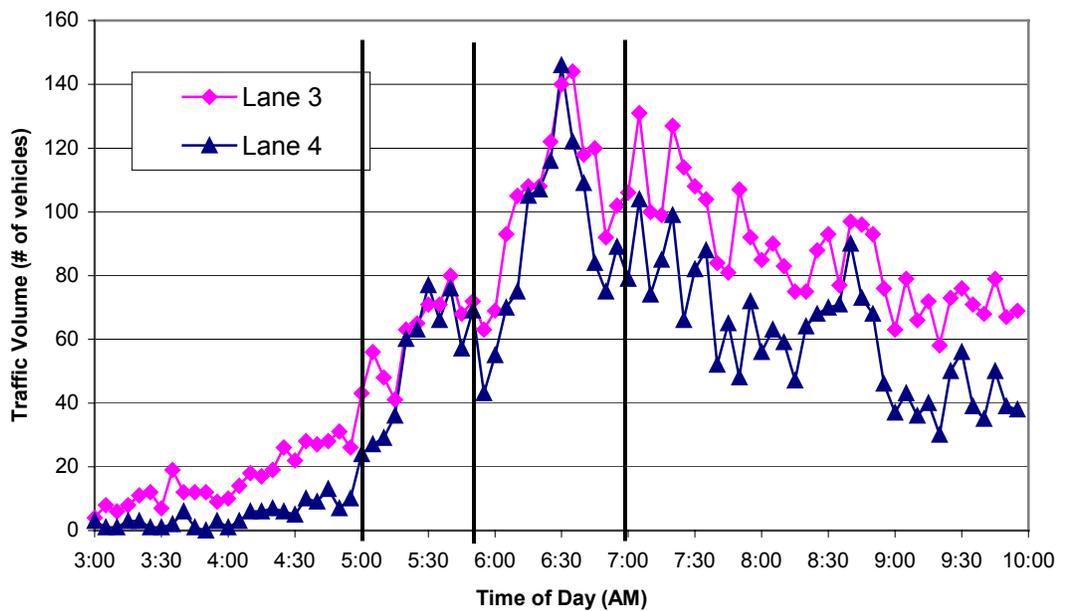
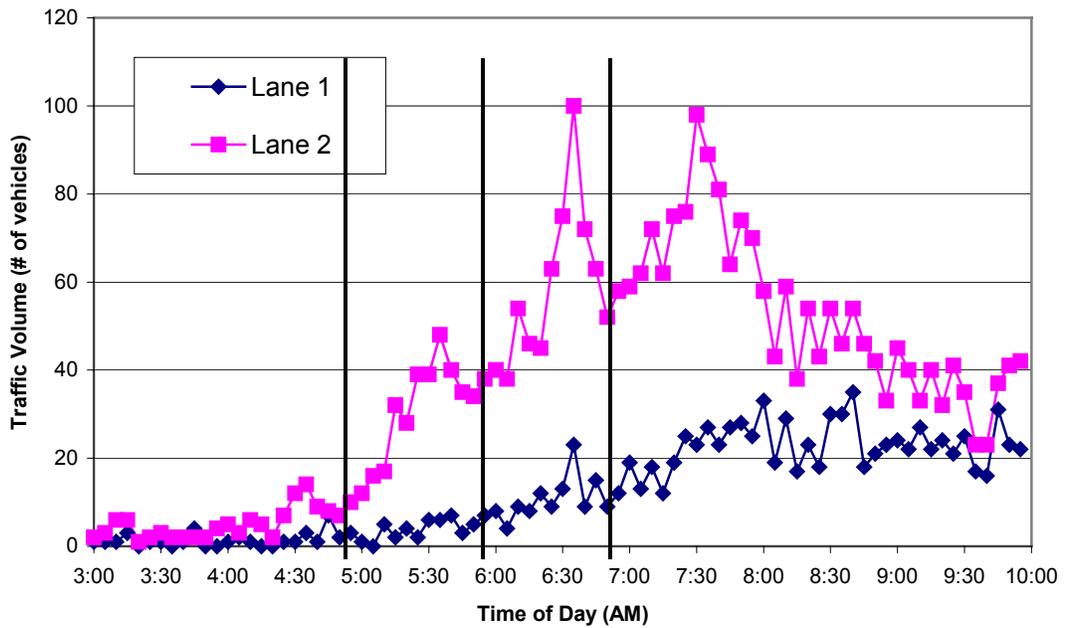


Figure A-13. Traffic Volumes for Site 265 (Lanes 1 and 2) on 9/19/01.

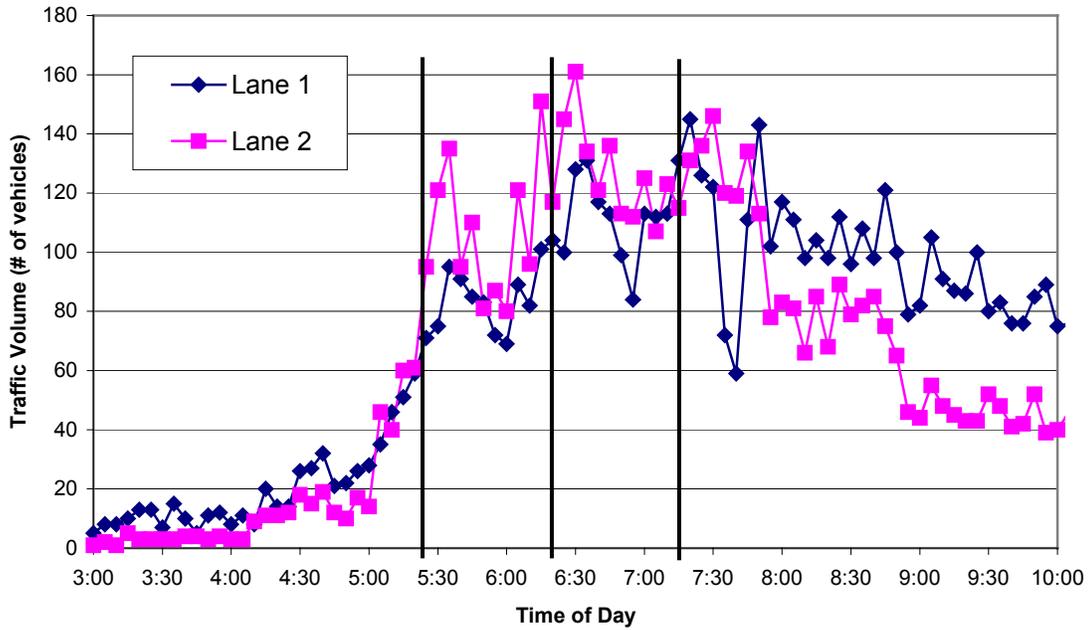
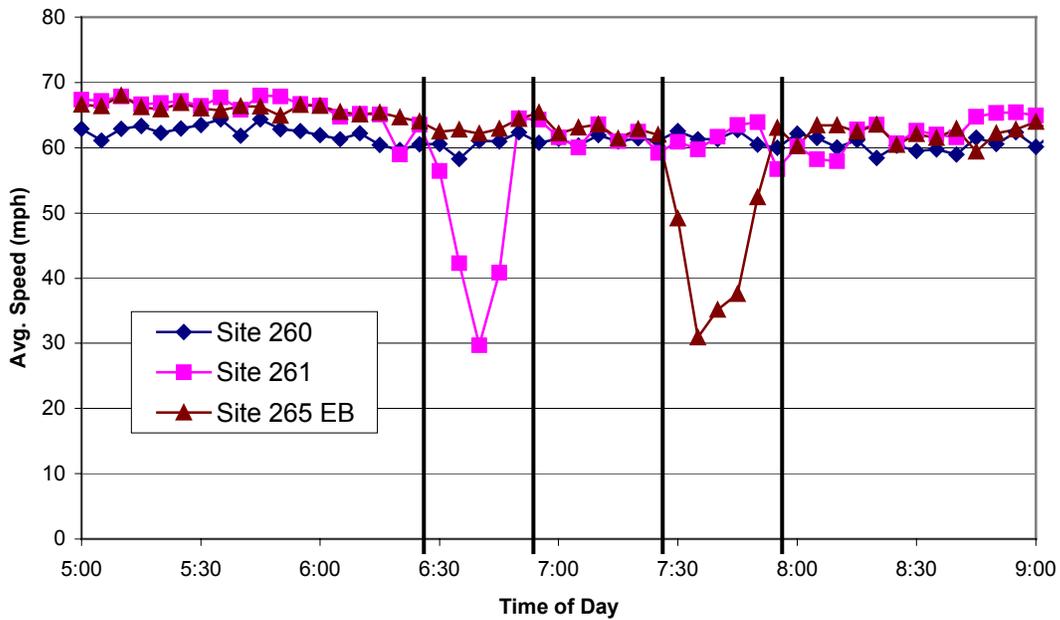


Figure A-14. Average Speeds Plot for Sites 260, 261, and 265 EB on 9/19/01.



October 31, 2001

Figure A-14. Traffic Volumes for Site 261 on 10/31/01.

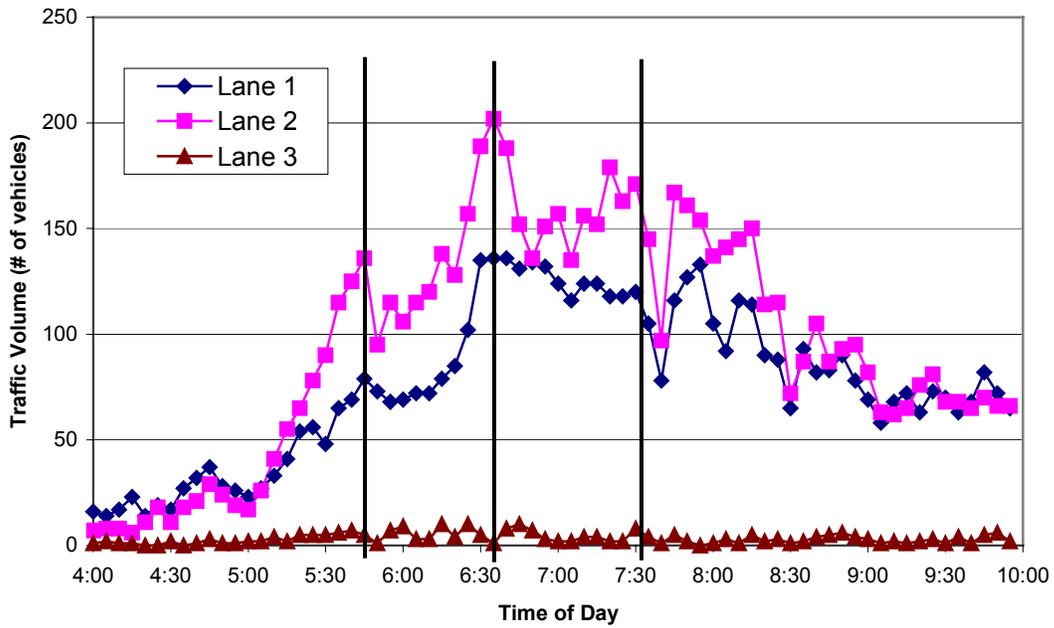


Figure A-16. Traffic Volumes for Site 265 on 10/31/01.

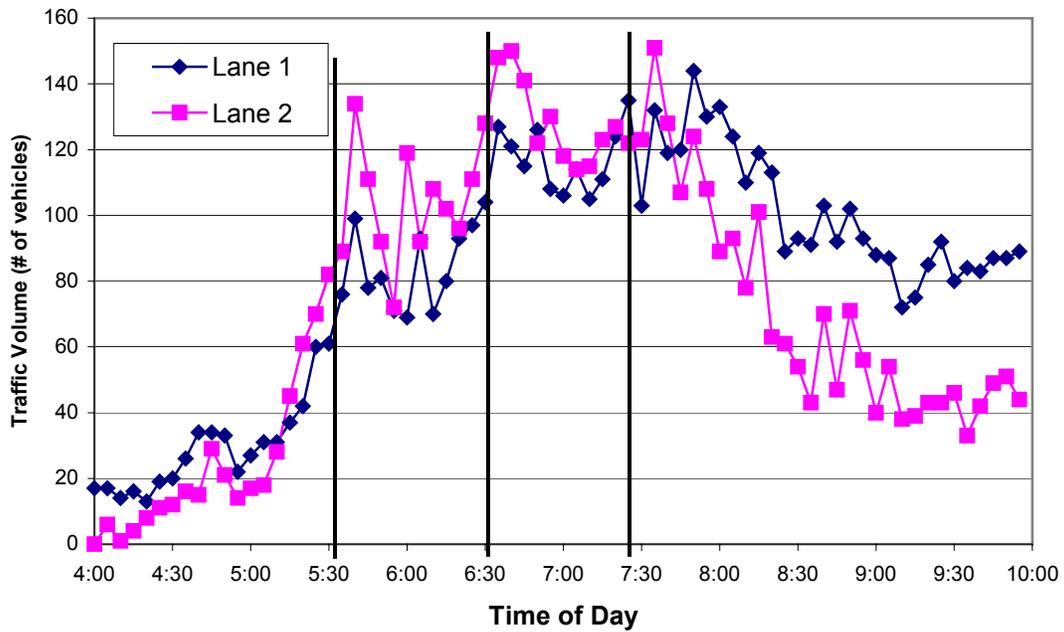
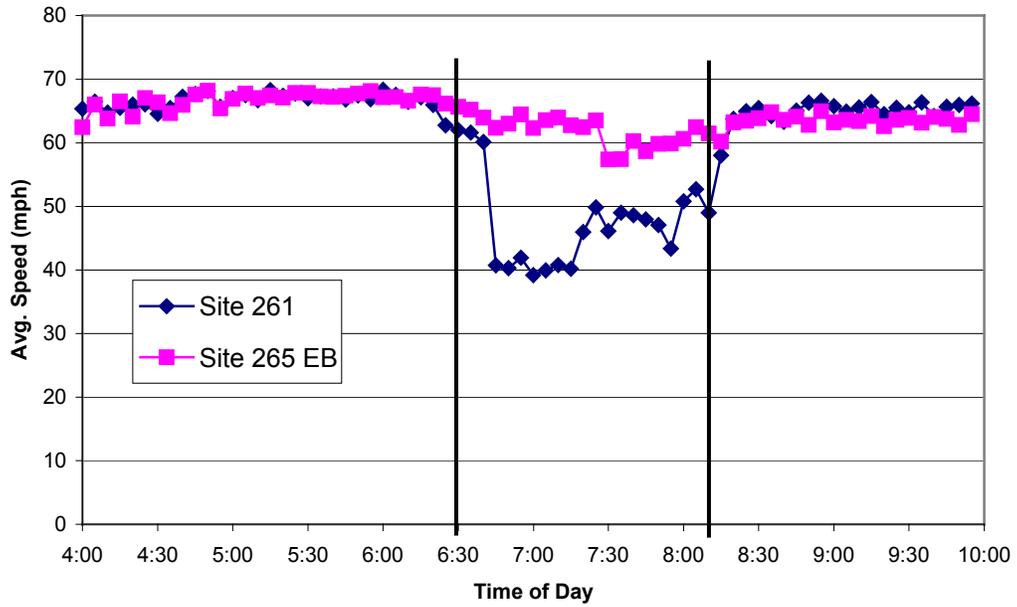


Figure A-15. Average Speeds for Sites 261 and 265 EB on 10/31/01.



February 4, 2002 (Morning)

Figure A-16. Traffic Volumes Site 265 on 2/4/02.

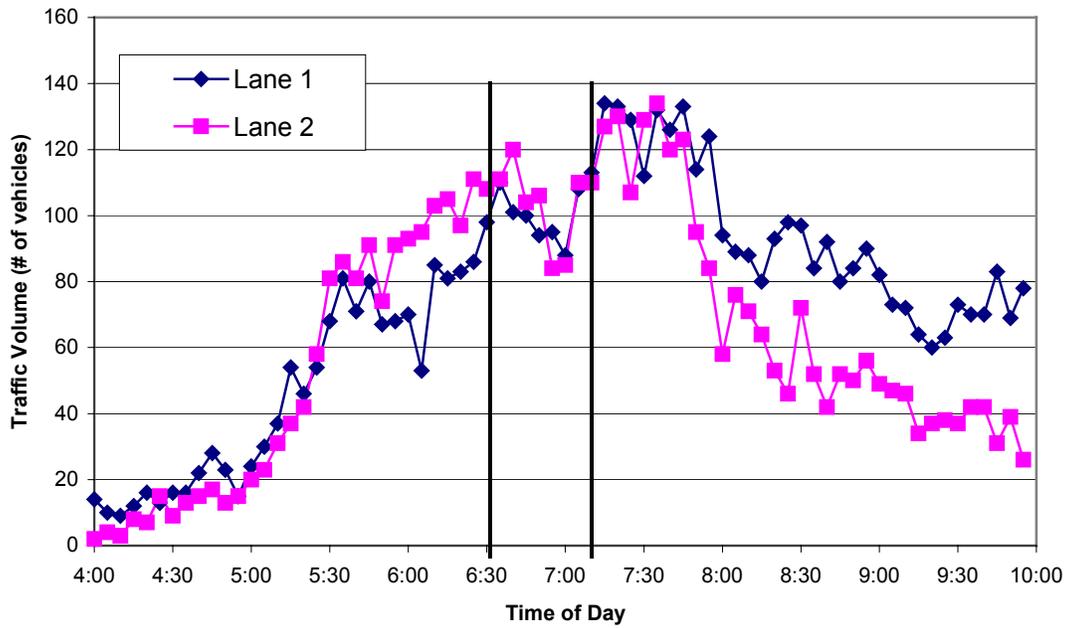


Figure A-17. Traffic Volumes for Site 002 on 2/4/02.

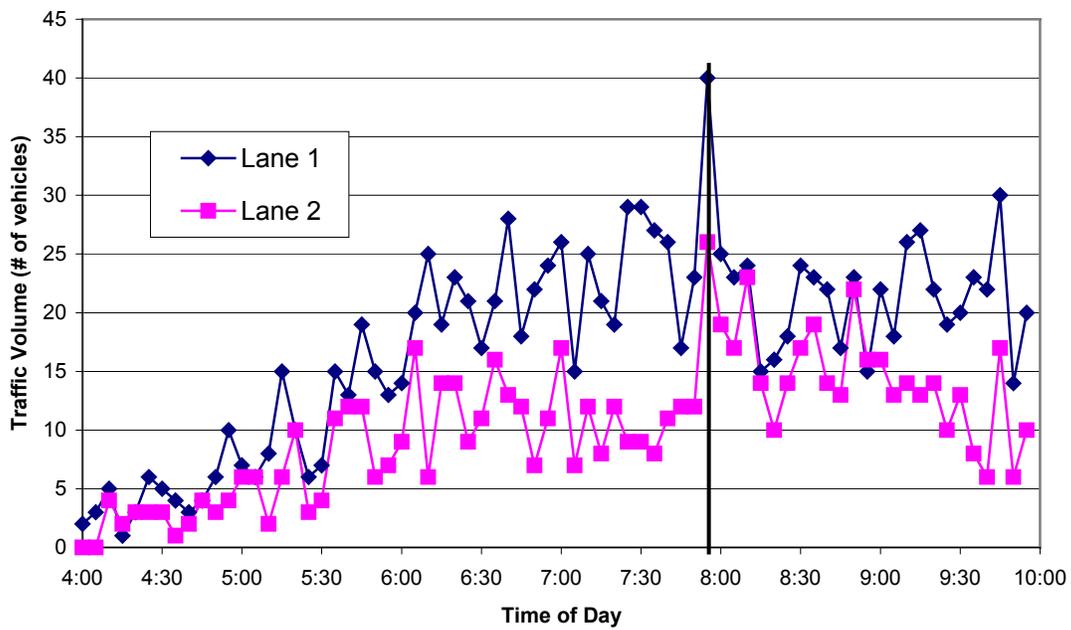
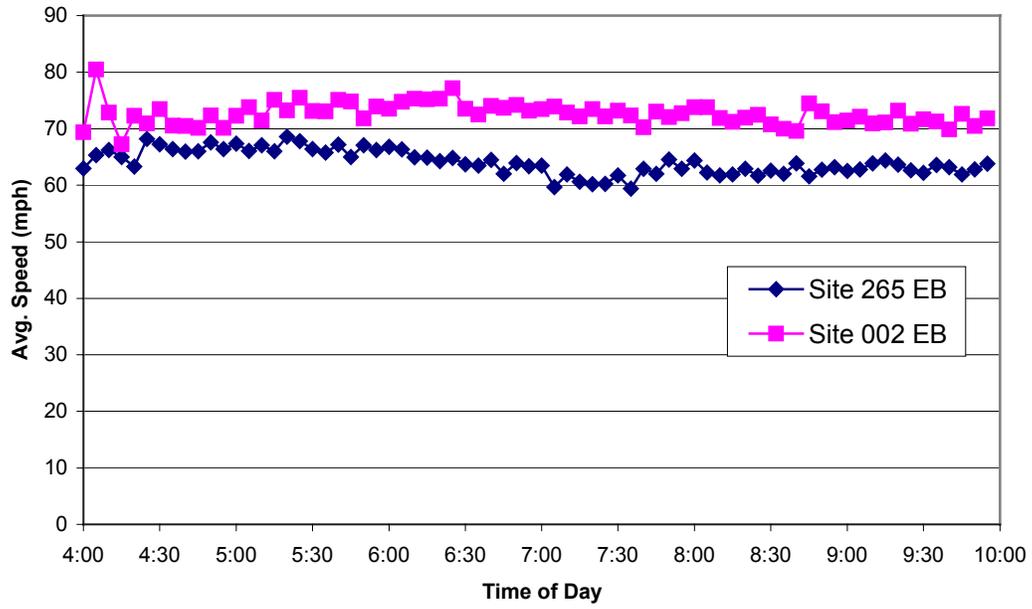


Figure A-18. Average Speeds for Sites 265 EB and 002 EB on 2/4/02.



February 4, 2002 (Afternoon)

Figure A-19. Traffic Volumes Site 122 on 2/4/02.

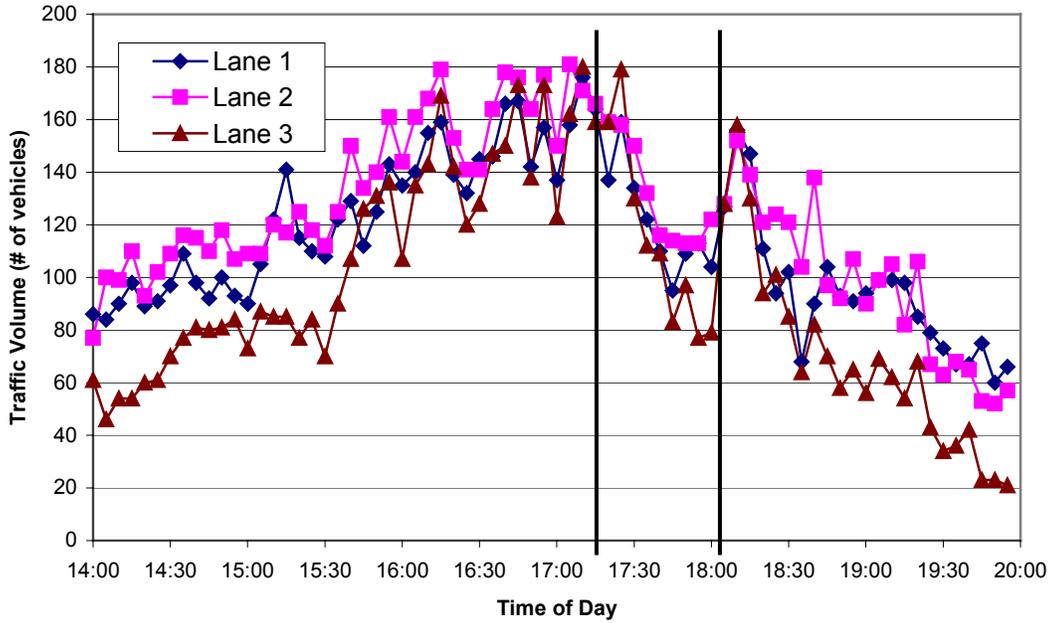


Figure A-22. Traffic Volumes for Site 263 on 2/4/02.

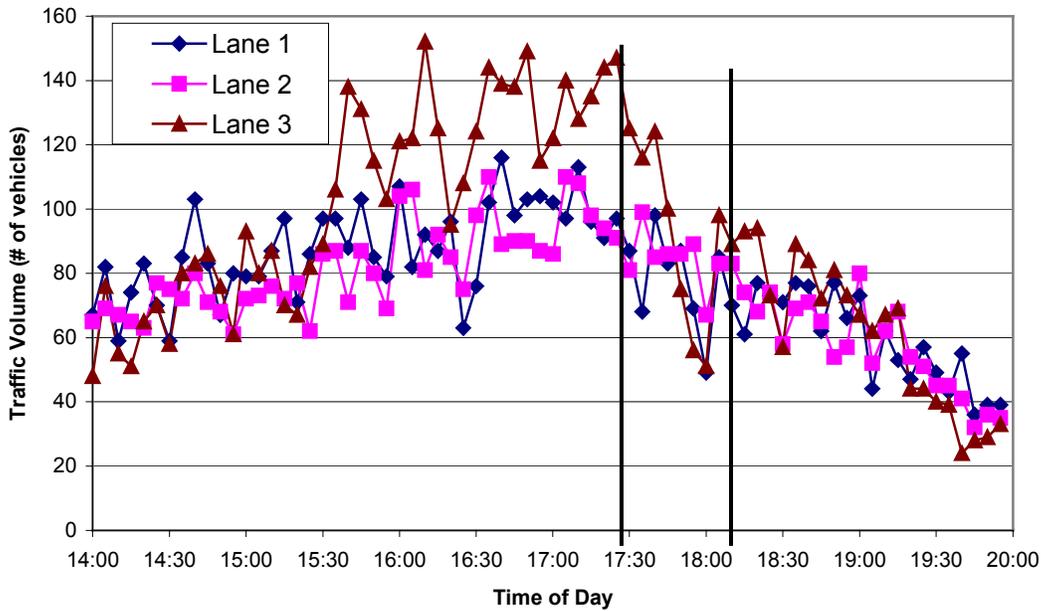
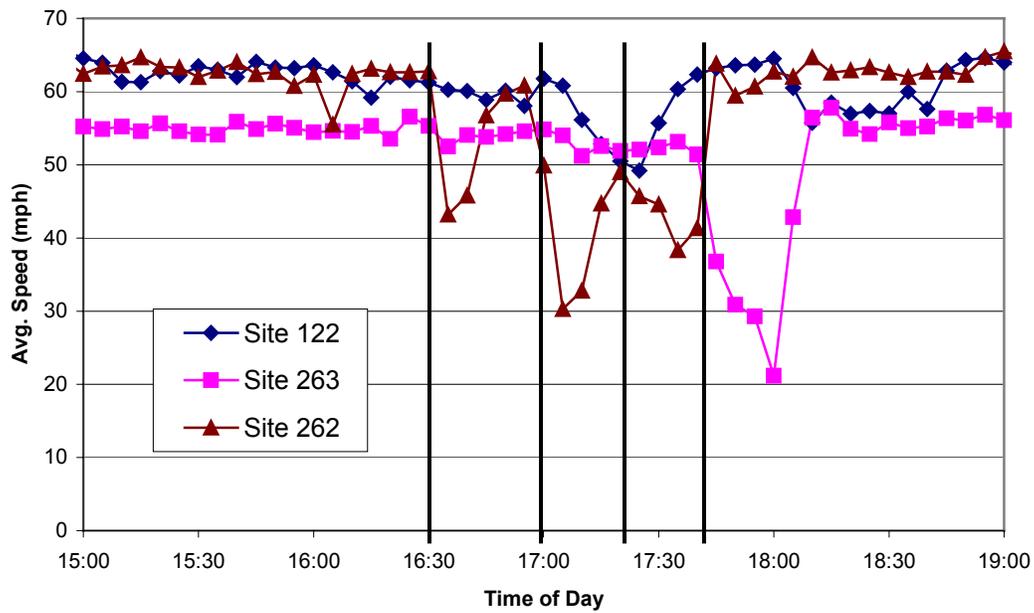


Figure A- 20. Average Speeds for Sites 122, 262, and 263 on 2/4/02.



February 14, 2002

Figure A-21. Traffic Volumes for Site 122 on 2/14/02.

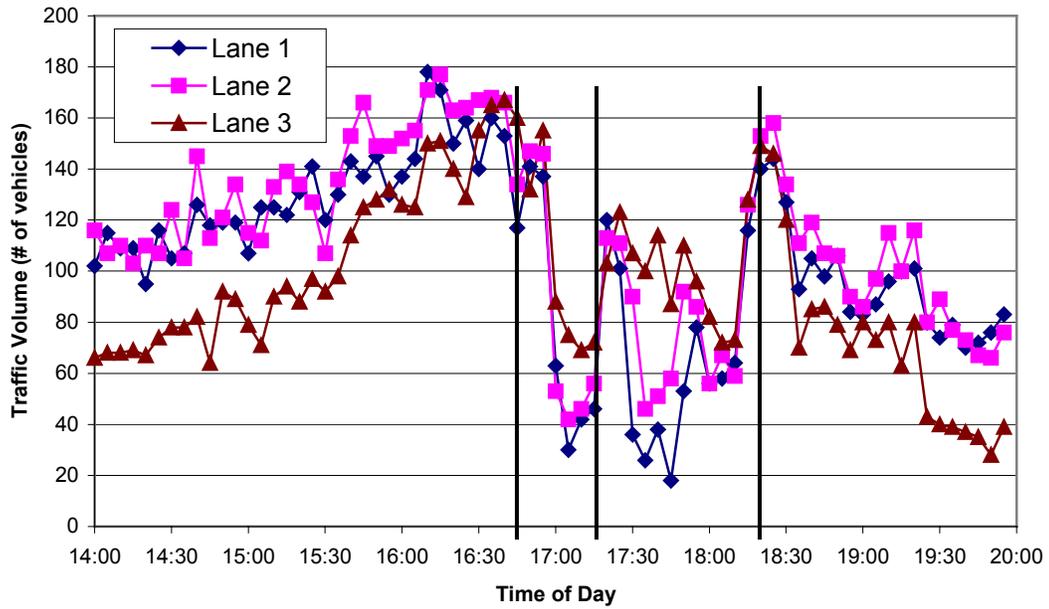


Figure A-22. Traffic Volume for Site 263 (Lanes 1 and 2) on 2/14/02.

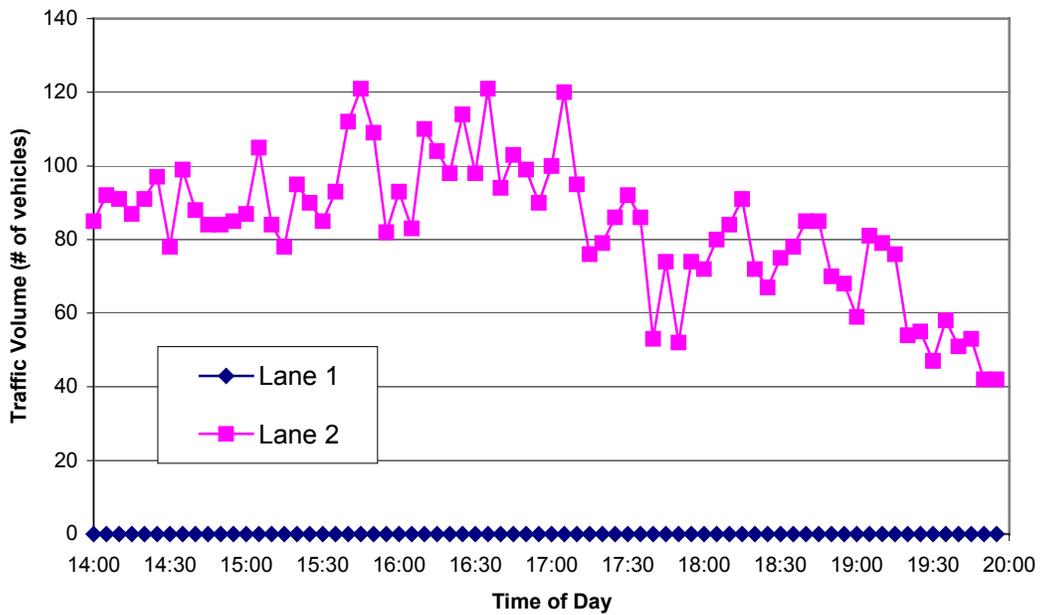


Figure 23 Traffic Volumes for Site 263 (Lanes 3 and 4) on 2/14/02.

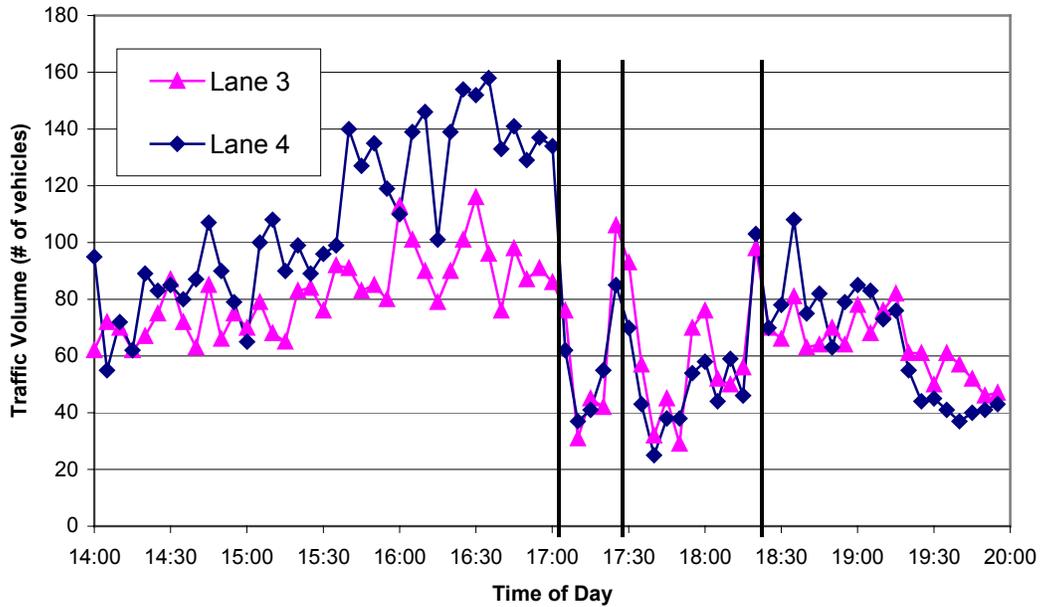
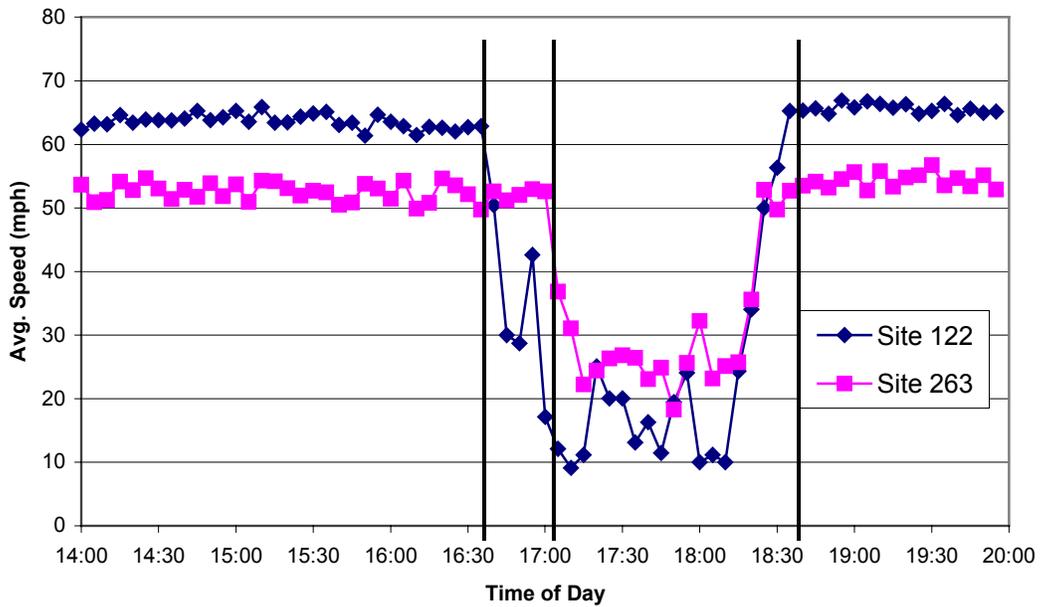


Figure A-24. Average Speeds for Sites 122 and 263 on 2/14/02.



March 22, 2002

Figure A-25. Traffic Volumes for Site 265 on 3/22/02.

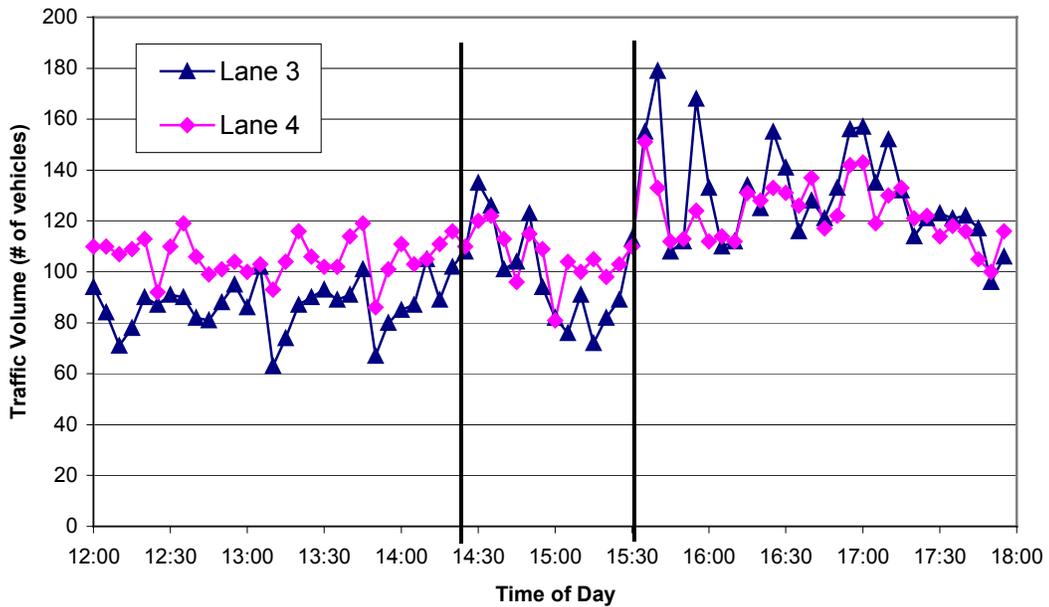


Figure A-26. Traffic Volumes for Site 002 on 3/22/02.

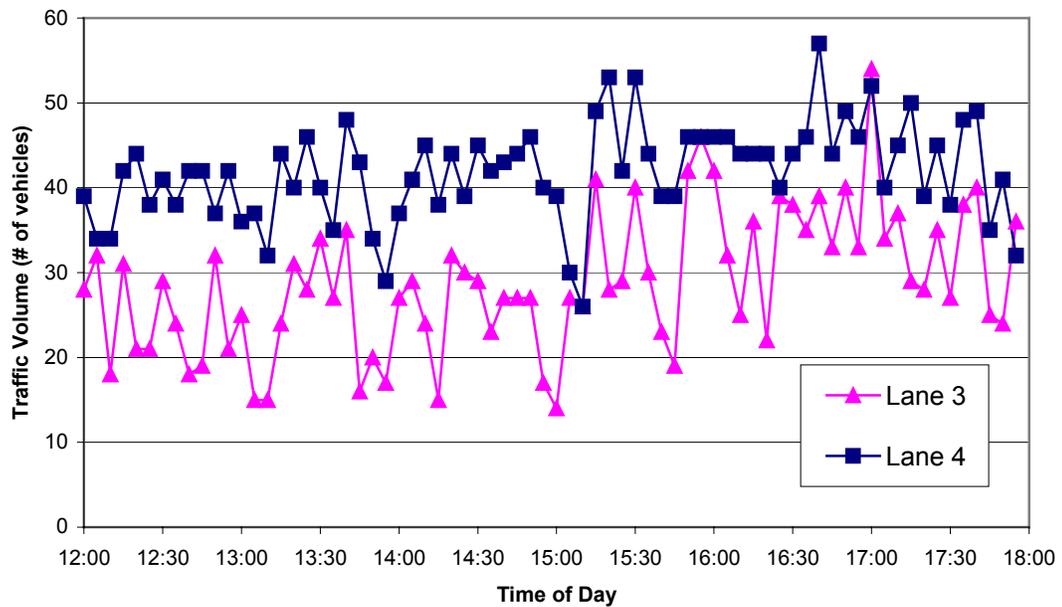
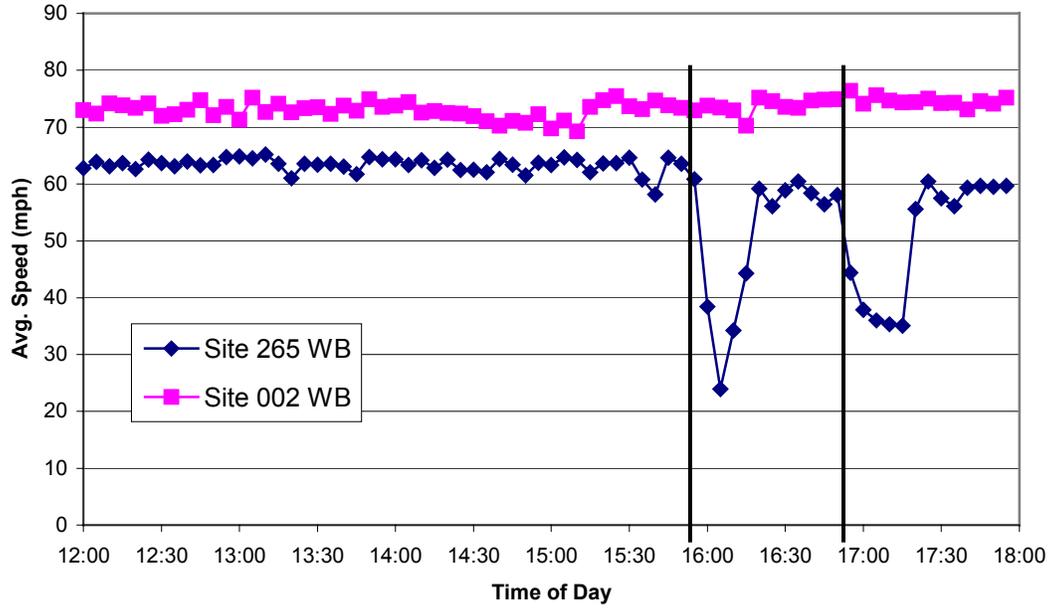


Figure A-27. Average Speeds for Site 265 WB and 002 WB on 3/22/02.



September 17, 2002

Figure A-28. Traffic Volumes for Site 262WB on 9/17/02.

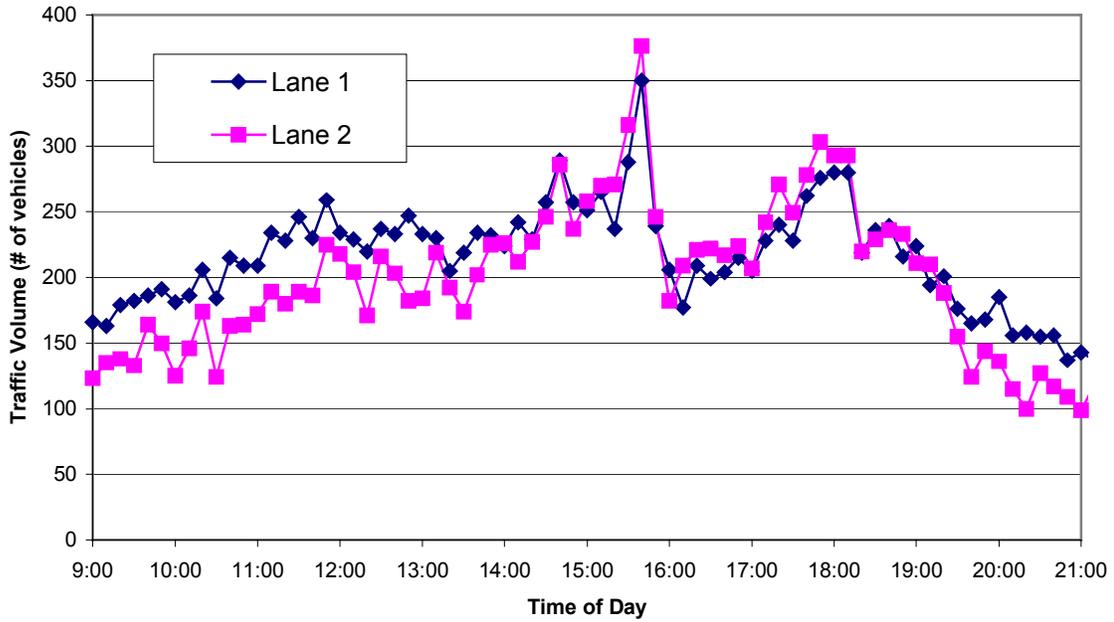


Figure A-29. Traffic Volumes for Site 265 on 9/17/02.

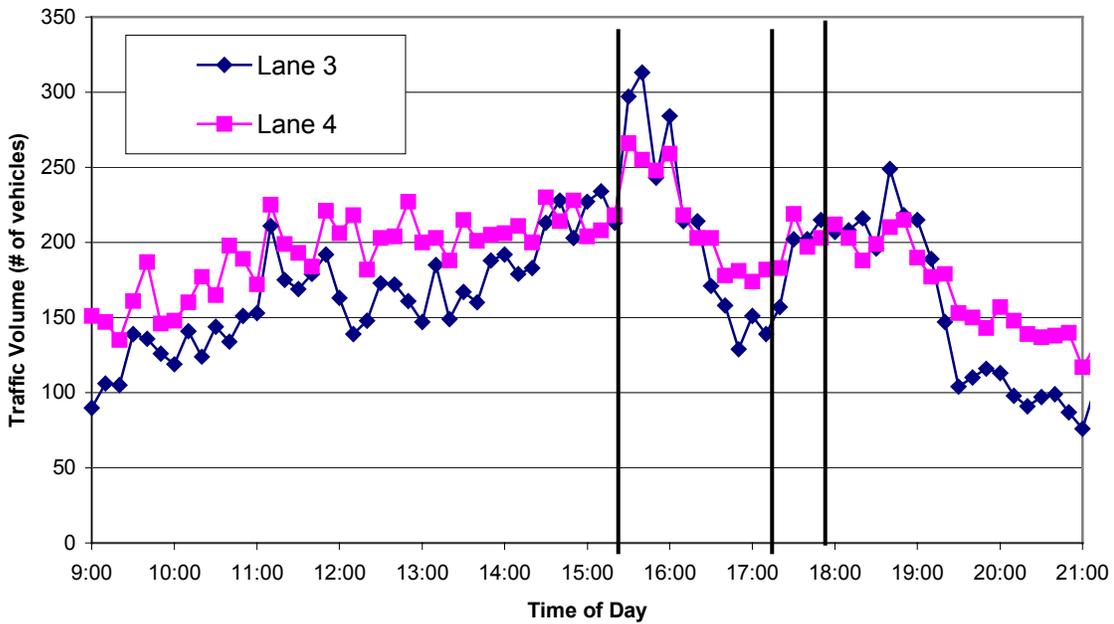
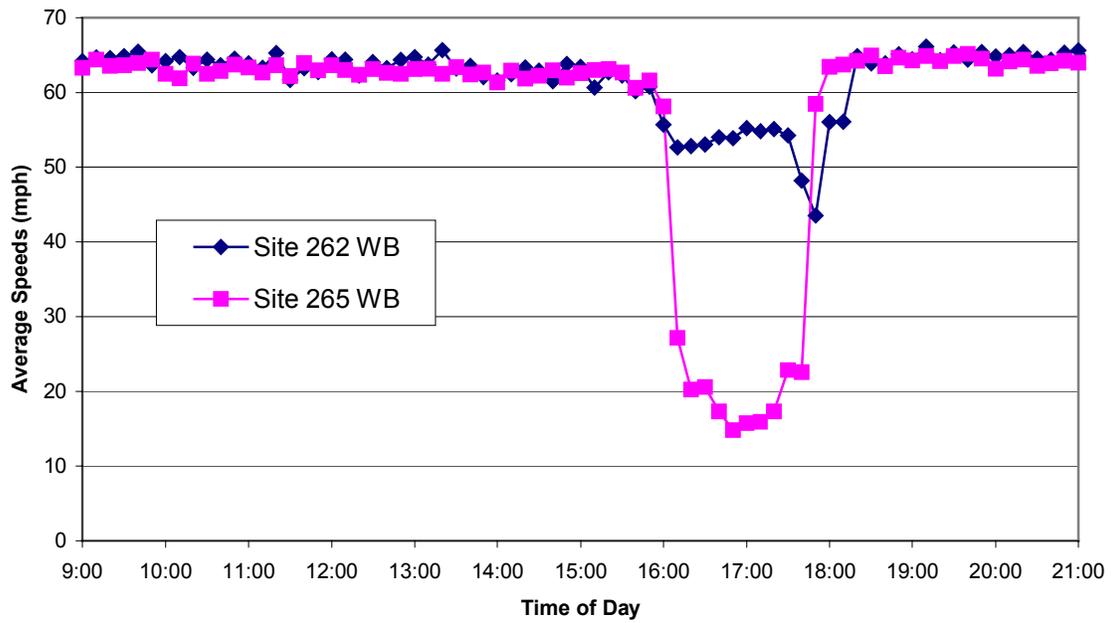


Figure A-30. Average Speeds for Site 262 and 265 WB on 9/17/02.



APPENDIX B: SCANNING TOUR QUESTIONS

SCANNING TOUR – QUESTIONS & FUNCTIONALITY

The following pages itemize functionality the evaluators should be looking for at each location.

It is important not to spend time on issues that will be resolved in the RFP process. Source code, development environments and tools, licensing, etc. will be addressed by the proposal process – the purpose of this tour is to establish a base of technical knowledge regarding software capabilities. ACHD will initially need a software package to control it's Diamond CCTV cameras, Daktronics DMS signs, and it's 2 detection systems, RTMS Radar and 3M Microloops.

The following general functionality should be looked for at each location (these are broken down into individual items in the following pages, as noted above):

Case Study – What is the scenario the system is being used in at this site? Does it approximate the Treasure Valley? What are the important differences and similarities?

Software – What functionality belongs to the native software and what is integrated from other applications?

Communications – What type of communications are used at this site to run the system? What impact does this have on system performance?

General – What are the overall good/bad aspects of the software package?

User Interface – What elements of the UI do you like/dislike? Is the content and functionality intuitive on the individual screens?

System Map – Does the map provide the appropriate level of information in a usable manner?

Detection System – What level of detection system control is available from the software UI? What functions do you like/dislike?

Camera Control System – What level of camera and video control is available from the software UI? What functions do you like/dislike?

Sign Control System – What level of sign and message control is available from the software UI? What functions do you like/dislike?

Incident Management – Does the software provide for incident tracking and automated response plans, and how is it accomplished?

Traveler Information – What ATIS functionality is supported or may be integrated into the software package?

Reporting – How flexible is the software for providing system-based reports and data?

Administration – What level of access and configuration is available to system administrators?

Signals – Does the software support signal operations or does it provide for future integration of such control?

Case-Study / System Description

- Describe the system the software is controlling – number of devices, types of devices (brands), operations in place, programs and system run from the TOC, input signals being received, etc.
- Who are the stakeholders in the system operations? Who is interfacing with the system for control, and who is interfacing for data/video?
- How long has the software been installed and operational? How stable is the software and system – does it crash, and if so, how often and why? What is required to bring it back online?
- In general, what are the strengths and weaknesses of the software? What would you change?

Software

- How often are the system servers re-booted, and why? How often are the workstations re-booted and why?
- What is required to install/configure the software – CD load, etc.? Can the operators do this or does it require an administrator/consultant rep.?
- How often do software upgrades become available, and what is involved in updating the current version at the TOC? Does each upgrade require additional cost? Are upgrades automatic? Is the software being viewed the latest version, and if not, why?
- How do you save/print from the software screens? Is it user-friendly?
- Which version of NT is the software optimized for? Which version is it currently running on? What configuration/compatibility problems have you experienced?
- Does the software support multiple monitors? (NT supports this functionality)
- What type of PC's and hardware are used to support the software, and why were these chosen? What changes are desired?

Communications

- How are the various stakeholders interfacing with the system, and what kind of provisions – if any – had to be made (institutional issues, technical issues) to allow these interfaces to occur?
- Do your operators utilize radio at their consoles? Is there any connection between the radio systems and the software?
- Does your software have any integration with your telephone service? If so, how?
- Does your software support or provide ‘hooks’ to directly integrate with external systems (i.e., transit, State Police, etc.)?
- What kind of communications infrastructure do you utilize to support operation of the software and full ATMS system? Describe the various components.

General

- What industry/national standards do you have in place currently which are supported by the software? What standards are you bringing online in the future, and do any of these require software modification to implement?
- What functionality within your system is native, and what has been added especially for your application?
- What functionality is currently in development for the next version of software?
- In the opinion of the users, what are the best/worst features of the software system? Why? What is required to add/remove such functionality to/from the native software?
- How responsive is the system – does it start-up quickly, do actions take place immediately, do windows open/close quickly, etc.?
- Describe system security – is it configurable, and how (internal users, remote users, web security)?
- How does the system operate – is it based on one or more database fields? How accessible is the data to custom application development and integration?
- How do you handle backups? In the event a restoration is needed, how is this accomplished?
- Does the software/system allow for standard office software (word processing, browsers, etc.) to be used when it is running? Is internet/email accessible? Do Windows functions work within the software windows (i.e., copy/paste, etc.)?

- What maintenance support capabilities are provided by the software, such as work order generation?
- Is a hook for Ramp Metering control provided? Describe the elements of the control for this system.
- What kind of software support is available for the system? Is it currently in place, and if not, why? Has the support been satisfactory, and what would you change?
- Can the system be configured (i.e., new devices added) online, without rebooting the software?
- What manual tasks is the operator still required to do? Why are these tasks not addressed by the software?
- What is the process for adding an additional workstation to the original configuration of the system?
- How is virus protection addressed? Are there compatibility issues to be addressed in using specific virus protection products?

User Interface

- How does the system handle multiple users controlling devices? What policies or technical features are in place to control multiple user access?
- Does the software enable control of peripheral equipment, such as VCR's, ATIS elements, 3rd-party software, etc. through it's native interface? What is currently being controlled?
- How many concurrent users can the system support? Can the software run both locally and remotely concurrently, with fully-independent sessions for each user?
- In the opinion of the users, is the software interface intuitive in content and control? Are controls and data where the user expects them to be, when they expect them to be there?
- What do the mouse buttons do?
- Is the flow of the program logical – i.e., can operations be performed with minimal windows, buttons, and time being used?
- What 'extras' are provided – i.e., fly-over mouse tags, program colorization, command lines, etc.?
- Does the software provide alarms and notifications for definable events, such as device/comm failures, events, specific data inputs, etc.?

- How are system alarms disseminated? Pager? Visual notification on the map? Audible? Fax/Email? What would you change about this system?
- How does the program navigate and control operations/data – drop-down menus, buttons, command line text, other? How is this functionality received by the users?
- Are data and device control accessible from all locations where such is appropriate – i.e., main screen, map interface, status screens, etc.? How are they accessed?
- To what extent is the UI configurable – coloration, mouse actions, permissions, etc.? Does the software provide for individually defined user profiles or is it a one-size-fits-all program?
- Does the system ‘remember’ it’s last setting regarding which windows are open/closed, views on the map, etc.? Is this easily changed?
- As a user, what elements of the UI do you like most/least, and why? What is required to add/remove these items to/from the native software?

System Map

- Does the software support a map, and if so, what data elements are available in the native software package? How does it work? How many data types can be represented on the map?
- What data elements are currently displayed on the map, and how are different data states represented? How is the map used by the operators and remote users?
- What map features are available to be controlled by the operators?
- Does the map provide fly-over information details for specific devices, so the user is not forced to access additional screens to view the status of devices in the field?
- Is the map GIS based? What is the basemap? Does it support a ‘hook’ for use of GIS data, and what is required to implement such functionality?
- What are the pros/cons with using GIS versus another basemap format for the software (maintenance, capital costs, performance, etc.)?
- How responsive is the map? Do pan, zoom and view change operations occur quickly or do they require an extended wait?
- As a user, is the map adequate in representing features, devices, incidents, etc.? Font sizing? Coloration? Controls? Data layering (on/off)?
- How many individual map sessions can be open at the same time – by multiple users, by a single user? How quickly does system performance degrade with multiple sessions?

- Does the map allow for users to save view profiles under specific names, or default views to be opened when the map is opened?
- Describe how the map is configured – what is the process for adding devices or placing an incident?
- Are map zoom levels progressively more detailed in content? Are icons and elements scalable within the map, or does each view require separate icons?
- Does the map allow for ‘hotlinks’ to other programs or documents which require display within a browser or other 3rd-party software?
- Does the map support schematic views (graphical representations of intersections, ramps, etc.) as well as geographic views? How do users go between the two? What file formats are supported, and how are these constructed?
- As a user, what map elements or functions do you most/least like and why? How difficult is it to add/remove these to/from the native software?
- As a user, what elements of the map do you like most/least, and why? What is required to add/remove these items to/from the native software?

Detection Control & Systems

- What intervals of polling does the software support for detection devices, and how does the software poll/receive field data – real time, (X)minute bins, etc.?
- What data elements does the software support collection of from field detectors? What is currently being used?
- Does the software provide or allow integration of an archive for storage of detector data? How does this system work?
- Does the software provide a means for viewing the detection data – on the map, within the software windows (graphs, etc.), in reports, as delimited text files, etc.?
- Is detection data able to be integrated for other uses within the software, or is it currently integrated for such? Incident detection, operator alarms, speed flow maps and response plans or delay messages are examples.
- What field hardware is supported by the software – what type of controllers are currently being used to communicate with the software?
- As a user, what elements of the detection control system do you like most/least and why? What is required to add/remove these items to/from the native software?

Camera Control & Systems

- How intuitive and easy to use is the camera control system in general? As a user, what do you most/least like about the system and why? What is required to change/add/remove it within the native software?
- Is camera control via a joystick or on-screen buttons? Does the UI belong to the software package or is it simply a window displaying the camera vendor's software interface?
- Does the system support image capture – both digital and via VCR recording? Does it allow the user to specify one or more display points from a range of display devices for viewing camera feeds or playback video? Is multiplexing supported?
- Are the video display devices controllable by the software – i.e., projectors, VCR's – and can video be played back/recorded from/to any of these display points (matrix switching)?
- Does the software support user-defined camera sequences? How are such sequences defined and displayed?
- Are camera pre-sets supported by the software? How?
- Does the software provide a way to insert text within video images? How is this done, and at what point is the text inserted?
- What policies do you have on camera control and video distribution? Why? How do these policies work, what would you change? Are the policies driven in any way by the capabilities of the software package itself?

Sign Control & Systems

- Does the software support a message library, and what functions are available – multiple sign type messages (3 lines vs. 2 lines), saving of custom messages, etc.?
- Does the sign software support event scheduling? Is it interfaced (or can it be) with the response plan management system?
- As a user, what do you most/least like about the sign system and why? What is required to add/remove such functions to/from the native software?
- Does the software allow for operator custom-message creation on-the-fly?
- What 'extra' functions does the system have – spell checking, font-size adjustment, intensity adjustments, priority message hierarchies, etc.?
- Does the system log activity (message creation, changes, or postings), and if so, how?

Incident Management

- Describe your incident management program –
 - How do you detect incidents?
 - Describe the verification/response process ?
- What role does the software play in incident management?
- Is there any software connection between the TOC operators and dispatch (i.e., CAD)?
- Are incidents geo-coded for display on the map, such that they can be translated into GIS at a later date?
- What are the data elements collected during the incident? How is the incident tracked, updated, and closed out during it's life-cycle? Can this be changed (i.e., additional data added to the form, etc.)?
- Does the system provide an automated Incident Response or Response Plan Management system? Describe the elements, operation and integration of this system – what systems are impacted?
- How do the plans work – are they usable as-is when they are generated, or do they require constant and extensive modification by the operators prior to use?
- How difficult is it to change the baseline operational parameters of the plans (i.e., re-assign signs or incidents, re-define plans, etc.)
- Does the system automatically update response plans as incident parameters are changed or the incident is ended by the operator?
- Does the software support automatic incident detection algorithm operation? How is this operated, configured? Can multiple algorithms be utilized concurrently?
- As a user, what do you like most/least about the incident management software system? What is required to add/remove these items to/from the native software?

Traveler Information Programs

- Describe your ATIS program – what technologies do/will you use in disseminating information (i.e., 511, HAR, web, etc.)?
- How does the software assist in the ATIS program? Are there direct controls of ATIS elements available? Does the program provide any 'hooks' for integration of 3rd-party packages for ATIS element control?

- How are you currently (or how do you plan to) providing ATIS information to the media, public, etc.? What kind of institutional issues and technical issues did you encounter?
- Describe your internet site – how do you achieve integration with the data?
- Is a hook for TAT/HAR control provided? Describe the elements of the control for this system.
- As a user, what do you like most/least about the ATIS elements of the software? What is required to add/remove these items to/from the native software?

Reporting / Data Compilation

- What reporting/logging capabilities do you have?
- Do you, or are you capable of, providing real-time data or queries to the operators, remote users, or both? How is this system configured and how does it operate?
- Is data collected from the field stored in flat files or database format? How accessible is this data to external query?
- What system or user events are logged by the system, and how is this data made available?
- What archiving capabilities are available with the software? Is data kept and made available for hours/days/weeks? What happens then?
- Does the system provide databasing/tracking capabilities for hardware and devices, failures, status logs, etc.?
- As a user, what do like most/least about the reporting/logging capabilities of the software and why? What would be required to add/remove these items to/from the native software?

Database Admin / Configuration

- Who installed/configured your system?
- Who is responsible for operations/maintenance of your system(i.e., consultant vs. agency)?
- What would be/is required for you to handle system configuration and maintenance in-house?

Signal Control

- Does the software support (directly or indirectly) control of a traffic signal system? Describe the control software.
- Does the software provide a ‘hook’ for future integration of a 3rd-party signal control software package? How does this work and what would be required to implement such a program?
- Does the software allow for integration of signal display (interactive icons) within the map, or does it support display of a dedicated signal map?
- Does the system provide for signal timing changes as part of the response plans?

APPENDIX C: SURVEY RESULTS: SUMMARY

	Consulting Firms				EMS
Department	Six Mile Engineering	Transcore			Idaho State Police
Representative	Scott Jones	Michael Wright	Michael Wendland	Pat Fuller	Stan Passey
Was your agency involved in the project planning stage?	Involved for six months	Yes	Yes	Agency was, Pat was not	Yes
Were the needs of your agency considered?	N/A	Yes	Yes	N/A	Yes
Were the needs of all the agencies considered and valued appropriately in the planning?	N/A	Yes	Yes	Yes; traffic department from ITD could have been represented a little better	Yes
Will your Agency benefit from the deployment?	N/A	No	N/A	N/A	Yes
Did your agency provide any funds	N/A	N/A	N/A	N/A	Yes
Will the operation of your agency change as a result?	N/A	N/A	N/A	N/A	Yes
Do you have a direct communication link with the ACHD Traffic Management Center?	N/A	No	No	No	Not now but will
Do you share information with ACHD?	N/A	No	No	No	Not now but will
From your agency's prospective, what is the most important component of the ITS deployment?	N/A	N/A	N/A	N/A	CCTVs
What are the positive things you see in the ITS deployment?	N/A	Faster response time	Improved communication between county and state, better informed public about	The deployment is a betterment for the traveling public	Having so many indicator that will help

	Consulting Firms			EMS
Department	Six Mile Engineering	Transcore		Idaho State Police
			traffic conditions	detect traffic flow problems
What are the negative things you see in the deployment?	N/A	Planning was drawn out too long, in his opinion	There wan an error in the field staking that could have been avoided through better communication	ITS should be a part of every construction project, not just an after thought. A lot of time an money
How would you evaluate the institutional cooperation between the different agencies?	Didn't interact with a lot of different agencies, but at surface seem good.	Although most contact was with ACHD, there seemed to be pretty good cooperation between all agencies	Everyone got a long pretty well, noticed people worked together better in Idaho than in other places	Good Excellent cooperation, phenomenal team work
Anything else to add?	Project was a success, everything ran smoothly		Additional stake holders always tend to appear after a system is deployed, someone is going to feel left out	ACHD was without doubt the most involved, but it also had the most at stake. It is unique for a county to maintain and operate a system on a state highway, Jim Larsen has done an excellent job and so has everyone else The deployment has opened a lot of doors in helping everyone in the police department

Department	Planning Agencies		State Agencies			
	Canyon County	COMPASS	State Comm.	Idaho Transportation Department (ITD)		Ada County Highway District (ACHD)
Representative	Leon Jensen	Erv Olen	Wendi Tillman	Bryan Smith	Bob Koeberlein	Jim Larsen, Project Manager
Was your agency involved in the project planning stage?	Only attended 2 -3 meetings, first one in about 2000	Yes, energy behind the planning	Yes, very involved	Yes, at a minimum	Agency was; Bob was not	Yes, Put together the consultant review team
Were the needs of your agency considered?	As an agency, deployment had no effect; therefore no needs	Yes	Yes	Yes	Yes	Yes, main beneficiary
Were the needs of all the agencies considered and valued appropriately in the planning?	Meetings attended were informational, but did not discuss agency needs	Yes	Yes	Yes, but should have looked down the road little further	Yes	Yes
Will your Agency benefit from the deployment?	No, not as an agency	Yes, ease transportation planning	Yes	Yes	Yes	Yes, be able to see incidents as they happen, change signal timing on arterial streets to accommodate detour traffic
Did your agency provide any funds	No	Yes, Cash Match and Incline	No	Yes	Yes	Yes, provided most matching funds, crew did most of installation on freeway
Will the operation of your agency change as a result?	No	No	Yes	Yes	A little	Yes, added new TMC operator, developed internal document of policies and procedures
Do you have a direct communication link with the ACHD Traffic Management Center?	No	No, but should	Yes	Not yet; will soon	No	N/A

Department	Planning Agencies		State Agencies			
	Canyon County	COMPASS	State Comm.	Idaho Transportation Department (ITD)		Ada County Highway District (ACHD)
Do you share information with ACHD?	Not answered	Yes	No	Yes	Yes	N/A
From your agency's prospective, what is the most important component of the ITS deployment?	N/A	Fiber optics and CCTVs	Incident Management Plan	Every component	Incident detection, CCTVs, traffic counting	CCTV, new agency partnerships
What are the positive things you see in the ITS deployment?	Will benefit Canyon County citizens in a positive way	Ability to get information to the public and having traffic signals that better meet the demand of the public	Brought people working together to help the public	Better able to detect and respond to incidents on the road	Ability to share video and data information	The development of the Incident Management Plan and sharing the plan with the cities and police departments
What are the negative things you see in the deployment?	Very expensive; "federal money always comes with strings attached"	It could be better integrated and a better way of responding to emergencies could be implemented	Some agencies are still adjusting and some still need convinced that the deployment is a positive change	TMC location	Cost a lot of time and money	Could have had better participation (i.e., ITD); project should have been marketed a little better in the beginning stages

Department	Planning Agencies		State Agencies			
	Canyon County	COMPASS	State Comm.	Idaho Transportation Department (ITD)	Ada County Highway District (ACHD)	
How would you evaluate the institutional cooperation between the different agencies?	Everyone was very courteous and got along great	It was pretty good, although some partners could have done more to be involved; ITD stood on the sidelines a little too much	Not so good at the beginning. At the end it was good but not excellent.	On a scale of 1-10 gives a 7 or 8. Over all agencies cooperated well	Good, but could have been better. Some mistrust and personality quirks surfaced	The cooperation between agencies was much better than I anticipated. Most agencies were excited about this first ITS project in the Treasure Valley. There have been many agency partnerships formed due to the onset of this project. This is a great step to ITS deployment in the Treasure Valley.
Anything else to add?	Key players on all the different agencies already knew each other	Would like to see a more seamless system that does not differentiate between state and local routes	ISP never sent the same person to the meetings, which made communication difficult			Very successful project, fairly low cost compared to other ITS projects.